Environmental Assessment Worksheet: Cambridge 2 Fuel Conversion

The human and environmental impacts of this dual fuel conversion project.

April 2023

Docket No. ET-2/GS-22-122

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Sources

Much of the information used to prepare this environmental assessment worksheet comes from the applicant. Staff verified this information and added information of their own. Additional sources include information from relevant federal and state environmental review documents for similar projects. Spatial data was used. Information was gathered from a site visit. Unless otherwise noted, all URL addresses are current as of March 1, 2023.

Project Mailing List

To place your name on the project mailing list contact docketing.puc@state.mn.us or (651) 201-2246 and provide the docket number (22-122), your name, email address, and mailing address. Please indicate how you would like to receive notices—by email or U.S. mail. Placing your name on the project mailing list ensures you receive the most up-to-date information about the project.

Alternative Formats

This document can be made available in alternative formats, that is, large print or audio, by calling (651) 539-1530 (voice).

Note to Reviewers

Comments must be submitted to the Public Utilities Commission during the 30-day comment period following notice of this environmental assessment worksheet in the EQB Monitor. Comments should address the accuracy and completeness of information, potential impacts that warrant further investigation, and the need for an EIS.

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ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
Air Permit	Title V Part 70 Air Emissions Permit 05900014-104
amsl	above mean sea level
applicant	Great River Energy
AST	aboveground storage tank
BMP	best management practice
CH_4	methane
CO	carbon monoxide
Commission	Public Utilities Commission
DNR	Department of Natural Resources

EAW environmental assessment worksheet

energy storage project Joint GRE and Form Energy long duration energy storage pilot project

EQB Enivornmental Quality Board

F Fahrenheit

facility Cambridge Station

FWS United States Fish and Wildlife Service

GRE Great River Energy

HAP Hazardous Air Pollutants

kg/mmBtu kilograms per Metric Million British Thermal Units

MAAQS Minnesota Ambient Air Quality Standards

MDH Department of Health

MISO Midwest Independent System Operator

MPCA Pollution Control Agency

MW megawatt

N_2O nitrous oxide

NAAQS National Ambient Air Quality Standards

NHIS Natural Heritage Information System

NLCD National Land Cover Database

NO_X oxides of nitrogen

NPDES National Pollution Discharge Elimination System

NWI National Wetland Inventory

PM particulate matter

project Cambridge Station Unit 2 Fuel Conversion Project

RASS Air Emissions Risk Assessment Screening Spreadsheet

RO reverse osmosis

ROC region of comparison

SIL significant impact level

SO_2 sulfer dioxide

SO_3 sulfur trioxide

SPCC spill prevention control and countermeasures

tpy tons per year

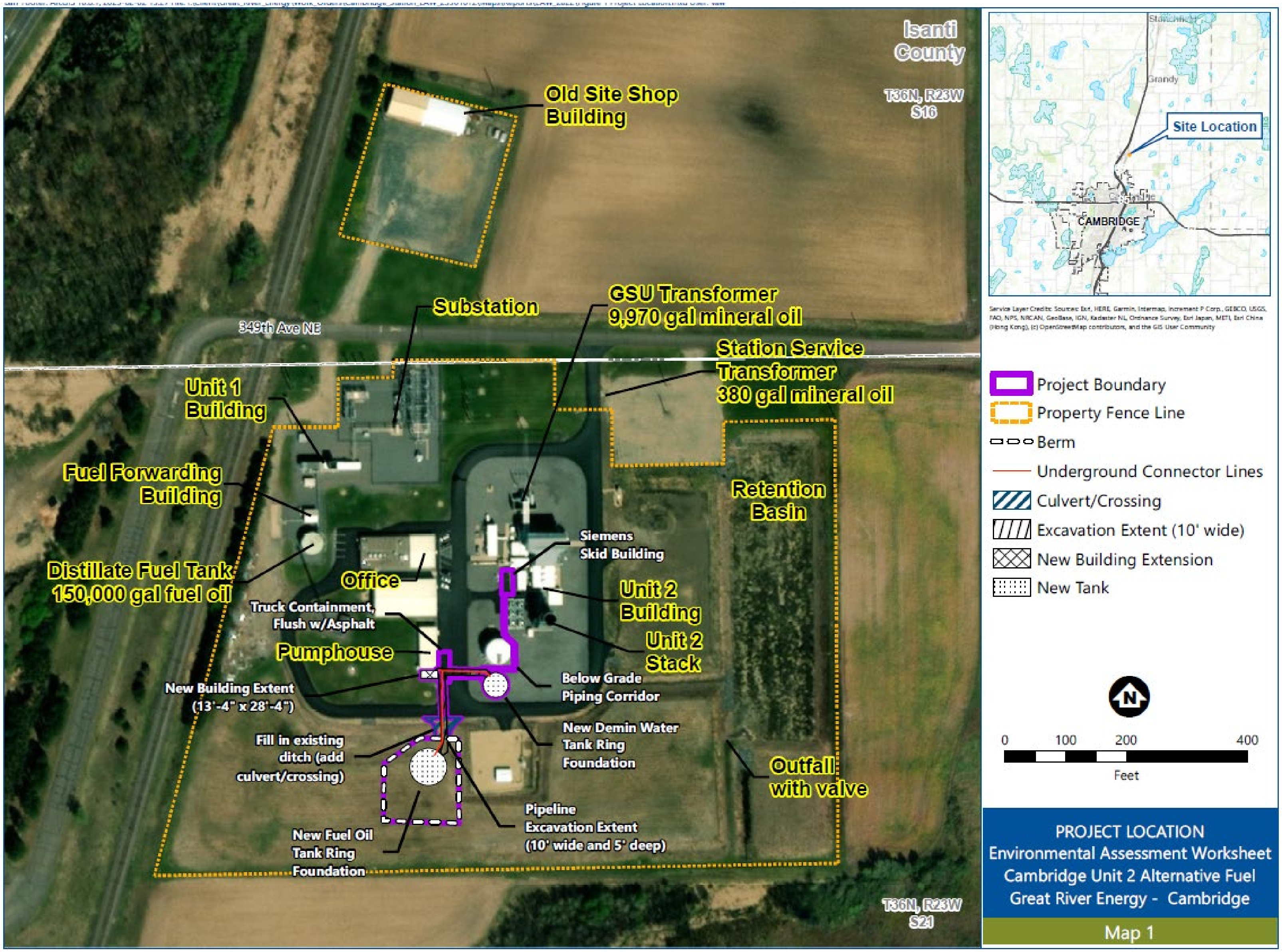
ULSD ultra-low sulfur diesel

Unit 1 CT Cambridge Station Unit 1 Combustion Turbine

Unit 2 CT Cambridge Station Unit 2 Combustion Turbine

VOC Volatile Organic Compounds

Project Overview Map



1. Project Title

Cambridge Station Unit 2 Combustion Turbine Ultra-Low Sulfur Diesel (ULSD) Fuel Conversion Project (project)

2. Proposer

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4. Reason for EAW Preparation

Required
☐ EIS Scoping
☐ Mandatory EAW
☐ Proposer initiated

Discretionary
X Citizen petition
☐ RGU discretion

5. Project Location

- **County** Isanti
- **City/Township** Cambridge Township
- **PLS Location** NE ¼ of T36, R23W, S21. GRE property also extends to T36, R23W, S16.
- **Watershed** Rum River (21)
- **GPS Coordinates** 93°12’27”W/45°35’59”N
- **Tax Parcel Number** 03.021.4200

6. Project Description

a. Provide the brief project summary to be published in the EQB Monitor, (approximately 50 words).

The project would replace existing natural gas burners with dual-fuel burners and install associated facilities to allow ULSD fuel oil combustion during periods of natural gas curtailment. The project is expected to protect GRE customers from extremely high energy prices. The project is located within GRE's existing Cambridge Station at 2438 349th Avenue NE; Cambridge, MN.

b. Give a complete description of the proposed project and related new construction, including infrastructure needs. If the project is an expansion include a description of the existing facility. Emphasize: 1) construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes, 2) modifications to existing equipment or industrial processes, 3) significant demolition, removal or remodeling of existing structures, and 4) timing and duration of construction activities.

GRE is a not-for-profit electric transmission and generation cooperative in Minnesota. It's Cambridge Station (facility) operates a 170 megawatt (MW) natural gas peaking plant that generates electricity in a backup capacity when the transmission network requires it to maintain reliability in times of high electric use and demand.

On March 11, 2022, GRE filed an application with the Commission for approval of a minor alteration to the site permit for the Unit 2 Combustion Turbine (Unit 2 CT). If approved, GRE would replace Unit 2 CT's existing natural gas burners with dual-fuel burners to allow ULSD combustion in addition to natural gas combustion. The applicant indicates that ULSD as a back-up fuel source is necessary to provide power during natural gas curtailments. GRE defines "curtailment" to mean when natural gas is unavailable or ULSD is more economical than natural gas. The project has an anticipated operating life of 30 years.

On May 25, 2022, the Environmental Quality Board (EQB) forwarded a citizen petition to the Commission requesting that an environmental assessment worksheet (EAW) be completed for the project.[1] The petitioners stated that potential for significant environmental effects might exist in the following areas: land use and management; natural environment; lands of historical, archaeological, and cultural significance; economies within the route; and human health impacts.[2]

The Commission met to discuss the petition on June 23, 2022. At this meeting the Commission granted the EAW petition stating "[t]he information included in the EAW will be relevant to the question of whether GRE's proposal would result in significant changes in the human or environmental impact of the facility and will therefore assist the Commission in making its decision on the minor alteration petition."[3]

Facility Description

The facility operates as a peaking plant, providing electricity during times of peak demand throughout the year. The facility consists of Unit 1 CT, a 29.3 MW distillate fuel-fired combustion turbine, and Unit 2 CT, a 170 MW natural gas-fired combustion turbine equipped with dry low nitrogen oxide (NO_X) burners. The facility also includes two aboveground storage tanks (ASTs) for water and distillate fuel, black-start generator, emergency diesel fire pump engine, emergency diesel generator, emergency Telecom propane generator, and other associated facilities such as a substation, control building, warehouse, distillate fuel pump house, and a telecommunications tower (**Map 1**). Unit 1 CT operates approximately 40 hours per

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[1] Environmental Quality Board (May 25, 2022) *Letter*, eDockets No. 20225-186172-01.

[2] Public Employees for Environmental Responsibility (May 25, 2022) *EAW Petition*, eDockets No. 20225-186172-02, at 4.

[3] Minnesota Public Utilities Commission (August 1, 2022) *Order Granting EAW Petition*, eDockets No. 20228-187993-01.

year and Unit 2 CT operates 400 to 800 hours per year due to a combination of Midcontinent Independent System Operator (MISO) testing and dispatch.

The facility is black start capable. The project would provide Unit 2 CT with an alternative fuel source which provides grid reliability and resiliency in the event of both a grid outage and natural gas curtailment.

Distillate fuel for Unit 1 CT is stored on-site in an existing 150,000-gallon double-walled AST south of Unit 1 CT on the western edge of the facility. Distillate fuel is pumped from the tank through aboveground piping to a fuel forwarding building north of the AST and then through additional aboveground piping to Unit 1 CT. Natural gas is delivered to the Unit 2 CT through underground piping from the Northern Natural Gas station immediately south of Unit 2 CT inside the facility fence line.

Unit 2 CT generates wastewater from the evaporative cooling blowdown unit during specific summer conditions. The blowdown unit cools and increases the density of air entering Unit 2 CT, which improves its power output and efficiency. Wastewater is sampled for pH, oil and grease, and total suspended solids before it is discharged to an onsite 1.85-acre retention basin. This 1.85-acre basin is on the east side of the facility.

Project Construction

New burners would replace existing burners on Unit 2 CT. The project would also require a 500,000-gallon ULSD AST, a 430,000-gallon demineralized water AST, and associated piping, pumps, and controls. A building extension to the south end of the existing pumphouse would be necessary to house some of this associated equipment. GRE will contract for a mobile reverse osmosis (RO) system that will use facility well water to make demineralized water. Demineralized water reduces NO_X emissions when co-injected with ULSD into the new burners. Demineralized water will evaporate in the combustion process.

The applicant indicates that construction planning and engineering is currently underway on both ASTs, the pumphouse extension, and underground piping. The new demineralized water AST will be built south of the existing Unit 2 CT demineralized water AST on an existing gravel pad. The new ULSD AST will be built south of the existing pumphouse (**Map 2**). Federal Spill Prevention Control and Countermeasures (SPCC) require a secondary structure to contain at least 110% of the primary tank's contents. To meet this requirement, the ULSD AST's design would include a vertical walled structure with a roof surrounding the primary AST. GRE points out that this structure would effectively result in a double walled tank.

Primary construction activities are expected to include:

- **Site Preparation** General grading will be performed using earth moving equipment.
- **Equipment Delivery and Staging** Delivered materials will be staged either in warehouse or laydown areas.
- **General Construction** Steps necessary to construct the ULSD and demineralized water ASTs, pumphouse, and fuel injection skids includes excavation of footings, pouring of concrete, and erection of steel.
- **Below Grade Piping** Includes trench excavation, installation of piping, and backfilling.
- **Various Testing** Includes hydrostatic testing and pressure/leak testing.

It is anticipated that construction activities will occur over a six- to seven-month period. Turbine work will occur over a two-month outage. During this outage a team from Siemens, the turbine manufacturer, will replace the burners. This team might work at night inside the existing turbine enclosure. Other work is expected to occur during daytime hours. Construction is scheduled for spring 2023 to be completed in time for commercial operation in early fourth quarter 2023.

The area for the new ASTs, injection fuel skids, and pump house addition will be excavated approximately two to four feet for concrete footings and foundations. GRE points out that geotechnical investigations indicate that pilings will not be required, and that groundwater is deep enough that dewatering will not be necessary. Underground services will be installed. At the same time, the foundations will be formed, and other miscellaneous equipment will be installed. Concrete work for all foundations will follow. Cable and pipe will be installed in the various foundations. Within one to two months of initial mobilization, truck deliveries will begin arriving at the site. These shipments will continue over a four- to five-month period. The timing of these shipments will coincide with the completion and readiness of their respective foundations. A construction crane will be located on site to lift large materials from delivery trucks onto foundations. The greatest number of on-site workers will be present during the erection of the ASTs, detailed wiring and piping, and while work is being performed on the combustion turbine.

Soil disturbance would be associated with underground pipework and AST foundations. All pipe connection points to the new ASTs and associated pumps will be aboveground. Pipes between these aboveground connections will be underground and protected from corrosion by a double walled pipe. Current estimates for underground piping indicate trenches will be less than 10 feet wide and no more than 10 feet deep. Groundwater elevation is approximately 10 feet below grade at the lowest point in the project area;[4] therefore, pipe trenches are expected to be at least three feet above groundwater level. As such, the need for de-watering during construction is not anticipated.

The new ULSD AST would be sited on pervious surface. Construction would convert this area into new impervious surface. Planned modifications to site grading and stormwater management for the ULSD AST will divert any potential ULSD spill to the north into an existing ditch which leads to the existing on-site retention basin. To promote surface drainage in the area around the tank to the existing drainage ditch, a high ridge to the south (or tie-in to existing grade) will ensure both a spill and precipitation only flows north (**Map 4**).

The remainder of construction activities occur on impervious surface. There is a catch basin southwest of the demineralized water AST. Ruoff from the building expansion and demineralized water AST would flow from this catch basin to the retention basin through a culvert underneath the road and follow the existing drainage ditch, much like the proposed ULSD AST.

Upon completion, excess materials will be removed from the facility and disturbed areas restored to previous conditions.

Operating Scenarios

The Commission's August 1, 2022, Order required GRE to list any specific "conditions or limitations" on the company's future burning of ULSD at the facility. GRE indicates it will not condition or limit burning

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[4] American Engineering Testing (February 2022) Report of Geotechnical Exploration Cambridge Unit 2 Dual Fuel Conversion Project, Appendix E.

ULSD beyond what it defines as a natural gas curtailment, that is, when natural gas is unavailable or ULSD is more economical than natural gas. Nevertheless, to better describe potential impacts, EERA staff asked GRE to develop several operating assumptions. These "operating scenarios" are discussed below. Note: Staff assumed that without the project Unit 2 CT would not generate electricity during a natural gas curtailment. Any USLD fuel usage would be additive to the status quo.

Scenario 1 represents a likely or typical ULSD annual operating assumption of 24 hours per year. It is based on annual average ULSD operation across GRE's combustion turbines with similar operating scenarios. These combustion turbines operated approximately six to 16 hours per year from 2011-2022. Natural gas represents the high end of the range of typical operating hours per year based on 2011-2022 actual hours of operation.

Scenario 2 represents a maximum annual operating assumption of 75 hours per year and is based on the maximum ULSD operating hours across GRE's combustion turbines during Winter Storm Uri in 2021. For example, GRE's Elk River Combustion Turbine, which is like Unit 2 CT, ran on ULSD for 50 hours during Winter Storm Uri. This was its highest annual ULSD operations since 2011. The assumption of 75 hours under this scenario is more conservative to account for unforeseen variability. This number was chosen to represent 3 days of operation, which is consistent with the maximum operations in Texas during the 2021 polar vortex. Natural gas represents maximum annual hours of operation based on 2011-2022 actual hours of operation.

Scenario 3 and **Scenario 4** represent the maximum hours Unit 2 CT could run on natural gas or ULSD, respectively. The current Title V Part 70 Air Emissions Permit 05900014-104 (Air Permit) limits NO_X emissions to 225 tons per year (tpy) for the entire facility. Under this permit, however, it is possible for GRE to operate the facility under an optional alternate operating scenario[5] that, when extrapolated to maximum fuel usage, allows for an increased operating NO_x limit of 240 tpy. To operate under the higher limit, GRE would be required to install a continuous emission monitoring system for NO_x and oxygen on Unit 1 CT. While GRE has no plans to install a continuous monitoring system, doing so represents the highest potential NO_x impact for the project. Therefore, it is used in the EAW to represent the maximum potential impact level.

c. Project Magnitude

Table 1 Project Magnitude

Component	Size
Total Acreage	0.46
Linear Length	--
Residential Units	--
Residential Building Area	--
Commercial Building Area	--
Industrial Building Area	380 ft^2
Institutional Building Area	--

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[5] In the Air Permit this operating scenario is called "alternate operating scenario 3."

Other Uses	--
Structure Heights	14 ft (pumphouse) 30 ft (ULSD AST) 40 ft (demineralized water AST)

d. Explain the project purpose; if the project will be carried out by a governmental unit, explain the need for the project and identify its beneficiaries.

GRE indicates the project serves several purposes, but primarily it would support dispatchable generation reliability and resiliency and help insulate GRE customers from potentially exorbitant prices during a natural gas curtailment.

The project would ensure that Unit 2 CT is available to operate on ULSD during a natural gas curtailment. In doing so, GRE states the project would provide its members a valuable hedge to market volatility during extreme winter weather events. MISO sets the maximum price that can be charged for electricity. This cap, called scarcity pricing, prevents prices from rising above $3,500 per MW hour. During Winter Storm Uri, electricity prices in Texas reached their equivalent scarcity pricing levels to those set by MISO. If, during a natural gas curtailment, market prices reached MISO scarcity pricing for 24 hours, Unit 2 CT's ability to generate electricity on ULSD would avoid 4,560 MW hours of purchases (24 hours multiplied by Unit 2 CT's winter capacity[6]) or an equivalent cost of nearly $16 million (4,560 MW hours multiplied by $3,500) less about $1.1 million for ULSD (24 hours multiplied by 13,500 gallons per hour multiplied by $3.50).[7]

The facility provides regional grid black start capabilities. In the event of a regional grid outage, the applicant indicates there are few facilities that provide this capability. The project would allow the facility to also provide black start capability during a natural gas curtailment.

Lastly, MISO has identified six "reliability attributes" as initial focus areas for future consideration. The project would be consistent with these attributes, especially fuel assurance and availability.

e. Are future stages of this development including development on any other property planned or likely to happen? X Yes ☐ No **If yes, briefly describe future stages, relationship to present project, timeline and plans for environmental review.**

The applicant is working with Form Energy to construct a long duration energy storage pilot project (energy storage project). The energy storage project will be within the facility fence line. Construction is anticipated to begin in 2024. The energy storage project is expected to be operational no earlier than fourth quarter 2024. The technology uses air to oxidize iron housed within clustered modules to charge a

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[6] The maximum output of Unit 2 CT fluctuates based on ambient temperature, fuel type, and other factors. Output can range from about 150 MW to 200 MW at temperatures from 90° Fahrenheit (F) to minus 20° F, respectively. Put simply, colder temps increase the mass of air flow through the turbine blades, which produces more electricity. Typically, engineers refer to a turbine's ISO condition at 59° F, which would be ~169MW and 162MW on natural gas and ULSD, respectively.

[7] Assumes -20°F and baseload operation and 4Q 2022 pricing.

cell for later electricity release. In total, there will be enough modules to provide 1.5 MW of electricity for 100 hours.

This energy storage project is not a part of the fuel conversion project but will have environmental effects on the same geographic area. As such, the energy storage project will be studied as a cumulative potential effect in this EAW. GRE assumes no other environmental permits, approvals, or reviews will be necessary to construct the energy storage project. However, should the total project disturb more than one acre, GRE will apply for a National Pollution Discharge Elimination System (NPDES) construction stormwater permit from the Pollution Control Agency (MPCA).

f. Is this project a subsequent stage of an earlier project? ☐ Yes X No **If yes, briefly describe the past development, timeline and any past environmental review.**

The project is not a subsequent state of an earlier project.

7. Climate Adaptation and Resilience

a. Describe the climate trends in the general location of the project and how climate change is anticipated to affect that location during the life of the project.

The project's purpose is to enhance reliability and resiliency during extreme winter weather events that lead to natural gas curtailments. Its anticipated operating lifetime is 30 years. This section follows the Minnesota EQB's January 2022 Revised EAW Guidance[8] and focuses on the winter climate change impacts that drive the project.

Climate trends in Isanti County were investigated using the Department of Natural Resources (DNR) Minnesota Climate Trends website.[9] This tool has an extensive array of both area and time scale options to evaluate historical temperature and precipitation trends throughout Minnesota. General climate trends forecast increasingly warmer winter temperature minimums which may decrease the necessity of the project over its lifetime due to fewer extreme winter cold temperatures. However, although average winter minimum temperatures are predicted to increase due to climate change, more frequent extreme cold events are also predicted in the future.

DNR climate trend data show an increase in winter month (December to February) minimum temperatures for the project area on average of 0.44°F per decade from 1895 to 2021 in Isanti County. For the same period, the average winter temperatures for Isanti County increased by 0.40˚F per decade.

The Who, What, When, Where, and Why of the Polar Vortex[10] indicates accelerated warming and ice melting of the polar regions have caused more instability in the circumpolar circulations (that is, the

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[8] Minnesota Environmental Quality Board (January 2022) Revised Environmental Assessment Worksheet (EAW) Guidance: Developing a carbon footprint and incorporating climate adaptation and resilience, retrieved from: https://www.eqb.state.mn.us/sites/default/files/documents/EQB_Revised%20EAW%20Form%20Guidance_Climate_Sept%202021_1.pdf.

[9] Minnesota Department of Natural Resources (September 6, 2022) *Minnesota Climate Trends*, retrieved from: https://arcgis.dnr.state.mn.us/ewr/climatetrends/.

[10] Kornei, Katherine (May 12, 2021) *The Who, What, When, Where, and Why of the Polar Vortex*, retrieved from: https://eos.org/articles/the-who-what-when-where-and-why-of-the-polar-vortex.

circumpolar vortex), which results in a more north to south flow rather than an east and west flow causing sudden stratospheric warming events. These events can push the cold air of the vortices far off the pole to lower latitudes as compared to typical flow patterns. The most recent example of this phenomena was the polar vortex of February 2021 (Winter Storm Uri). Since 1979 (when satellite imagery became available), polar vortex events in the northern hemisphere typically occurred about once every other year.[11]

Beyond temperature trends, climate change will increase the frequency and duration of extreme rain events in Isanti County which might impact the project. As DNR described in *Our Minnesota Climate*:

> Heavy rains are now more common in Minnesota and more intense than at any time on record. Long-term observation sites have measured dramatic increases, including a 20% increase in the number of one-inch rainfall events and a 65% increase in the number of three-inch rainfall events. The size of the heaviest annual rainfall also has increased by 13%. These trends are seen across the Midwest, as annual precipitation in the region has increased by 5% to 15% from the first half of the 20th century (1901 [to] 1960) compared to more recent years (1986 [to] 2015).[12]

Further, DNR climate trend data show an increase in annual average precipitation of 0.38 inches per decade from 1895 to 2022. For the same period, the average winter precipitation in Isanti County increased by only 0.03 inches per decade.[13]

These increasing annual precipitation trends are noteworthy in the context of impacts on the facility's retention basin related to spill risk from the existing and new project ASTs. The new ULSD AST will be designed to meet federal Spill Prevention, Control, and Countermeasure (SPCC) requirements that dictate consideration of potential spills, discharge direction(s), and spill response practices. At a minimum, the new AST will have a vertical secondary containment capable of retaining 110% of the capacity of the tank with a roof to prevent the accumulation of stormwater. If there is a double catastrophic release event, such that both the primary and secondary containment is breached, the ULSD will be channeled north to an existing ditch and flow to the facility's retention basin. The retention basin would effectively function like a large oil/water separator because oil floats on water. GRE points out that because of the retention basin's locked outfall valve design that drains from the bottom of the basin, the basin could contain a ULSD AST spill, fill with stormwater, and then drain the stormwater from the bottom, while keeping the ULSD spill inside the facility. At a minimum, the retention basin can hold a 10-year, four-inch rain event plus the contents of the new ULSD AST. This design is more protective than Federal SPCC requirements, however, it is unlikely to entirely contain contents from a 100-year or 500-year storm event, which are predicted to increase in intensity and frequency due to climate change.

Southeast of the facility is a Federal Emergency Management Agency identified 100-year flood zone wetland (Zone A), which flows from northeast to southwest towards the Rum River. This flood zone crosses the southeast corner of the property, adjacent to the locked discharge outlet from the retention basin. In the event of a flood, this valve can remain closed/locked beyond a 10-year, four-inch event and

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[11] Garthwaite, Josie. (February 5, 2019) *Polar Vortex: The science behind the cold*, retrieved from: https://earth.stanford.edu/news/polar-vortex-science-behind-cold.

[12] State of Minnesota (September 6, 2021) *Minnesota is getting warmer and wetter*, retrieved from: https://climate.state.mn.us/minnesota-getting-warmer-and-wetter.

[13] *Supra* note 8.

would keep flood waters out of the retention basin and effectively off the facility until flood waters receded through the Rum River watershed. This outfall structure controls water on either side to approximately five to six feet above grade, which is the indicated flood zone level. The retention basin is not designed to hold a 100-year rain event; therefore, such an event would require opening of the valve.

DNR climate trend data includes a Palmer Drought Severity Index, which uses temperature, soil, and precipitation data to determine water excess or deficit moisture for the given data period. A positive number reflects water excess (less drought) whereas a negative number reflects a deficit in moisture (more drought). In Isanti County, for each month in the year from 1895 to 2022 there is a monthly increasing trend on the Drought Severity Index which indicates less drought. Although Isanti County is showing positive drought trends, climate change is expected to increase drought events and severity. Drought can be a component of increased wildfire risk. Cambridge's wildfire risk is low.[14] In addition, potential fire risks impacting the project are mitigated in part by the lack of trees within the facility, and by the facility fire pump, which can be used for localized fire control.

Operation of the project would require an additional 300,000 to 950,000 gallons of groundwater per year for operating Scenarios 1 and 2, respectively. These values are accounted for in the facility's current DNR water appropriations permit. The applicant states that because the DNR water appropriations permit already allows for this increase, contingency plans beyond established regulatory limits are not needed at this time. Water is appropriated from GRE-owned wells on GRE property. This limits the potential for these increased water withdrawals to impact the Cambridge's water resources in times of diminished water supply availability.

Climate change will increase future extreme heat vulnerability making electricity reliability an important mitigator in protecting the population from extreme heat. While Cambridge Station is expected to play a role in protecting the population from extreme heat, the project is not. The project is only expected to insulate GRE customers from potentially exorbitant prices during a natural gas curtailment caused by an extreme cold weather event.

The project is expected to allow the facility to remain capable of providing critical electrical reliability and resiliency services during more frequent and extreme weather events.

b. For each Resource Category in the table below describe how the project's proposed activities and how the project's design will interact with those climate trends. Describe proposed adaptations to address the project effects identified.

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[14] Risk Factor Risk Factor™ is a free online tool recommended by the Environmental Quality Board's January 2022 *Revised Environmental Assessment Worksheet (EAW) Guidance* to find property risk from environmental threats due to climate change such as flooding, wildfires, extreme heat, and severe wind.

Table 2 Climate Trends

Resource Category	Climate Considerations	Project Information	GRE Adaptations
Project Design	Unit 2 CT will operate intermittently with ULSD as a backup fuel to natural gas, which (most notably) increases hourly NO_X emissions.	Nitrous oxide (N_2O) is a very minor component of total NO_X in combustion exhaust. In comparing the N_2O emissions from Scenario 3 (worst-case natural gas) to Scenario 4 (worst-case USLD), the difference in N_2O emissions is 0.941 tpy more for the latter. This is the carbon dioxide equivalent (CO_2e) to 280 tpy when using the global warming potential of 298 for N_2O.	None proposed. For comparison, Minnesota requires an EAW solely based on greenhouse gas emissions when a project exceeds 100,000 tpy of CO_2e, or greater than 99% of the project's worst-case fuel oil scenario.
Land Use	The primary land use primary impacts are within the project fence line, which is already an industrial site. The ULSD AST and pumphouse extension will increase the facility's overall impervious coverage by 0.14 acres.	Increased impervious surface due to the project is negligible and will be accommodated by the existing basin's design. However, the current basin is not designed to contain the volume from a 100- or 500-year storm event.	None proposed.
Water Resources	The project will increase groundwater use.	Estimated actual annual use is already within current DNR water appropriation allowances.	If the groundwater table lowers significantly, the facility would assess a deeper well or hauling water from off-site.
Contamination/Hazardous Materials/Wastes	ULSD is stored in ASTs designed with multiple layers of redundancy to prevent a fuel spill from occurring. Grading around the tanks diverts any potential flooding due to intense heavy rainfalls towards the existing ditch that empties into the existing stormwater basin.	The highest potential climate change risks and vulnerabilities are realized when more than one unlikely event occurs simultaneously, such as a 100-year storm event and a tank spill. In such a scenario, the basin onsite would overflow into the adjacent wetland, with drainage patterns ultimately reaching the Rum River.	None proposed. SPCC plans and secondary containment meet minimum regulatory requirements to mitigate such emergencies, which should suffice in most cases.
Fish, wildlife, plant communities, and sensitive ecological resources (rare features)	Project has minimal impact on ecological resources as its main impacts are contained within its fence line which is already an industrial site.	No climate change risks or vulnerabilities identified.	Not applicable.

8. Cover Types

Land cover types were estimated using the 2016 National Land Cover Database (NLCD). Results are summarized in **Table 3** through **Table 5** and shown in **Map 5**. All land disturbance—approximately 0.46 acres—would occur within the facility fence line. This includes about 0.11 acres of existing impervious surface. The new ULSD AST and associated access will impact about 0.14 acres of a constructed prairie (**Map 2**).

Table 3 Summary of Cover Types

Cover Types[1]	Before (acres)	After (acres)
Wetlands and shallow lakes	--	--
Deep lakes	--	--
Wooded/forest	--	--
Rivers/streams	--	--
Brush/grassland	--	--
Cropland	--	--
Rangeland/pastureland	--	--
Lawn/landscaping	--	--
Green infrastructure*	0.14[2]	0.00
Impervious surface	0.11[3]	0.25
Stormwater pond	--	--
Other	--	--
Total		

* From Table 4 below.

[1] Cover types were calculated for areas with direct project related surface disturbance.

[2] Includes area where the new ULSD tank, ring foundation, and access will be constructed.

[3] Includes area where the new underground connector lines, building extension, and demineralized water tank will be constructed.

Table 4 Green Infrastructure

Green Infrastructure	Before (acres)	After (acres)
Constructed infiltration systems (infiltration basins/infiltration trenches/rainwater gardens/bioretention areas without underdrains/swales with impermeable check dams)	--	--
Constructed tree trenches and tree boxes	--	--
Constructed wetlands	--	--
Constructed green roofs	--	---
Constructed permeable pavements	--	--
Other (GRE-constructed prairie)	5.64	5.50
Total	**5.64**	**5.50**

Table 5 Tree Cover

Trees	Percent	Number
Percent tree canopy removed or number of mature trees removed during development	--	--
Number of new trees planted	--	--

9. Permits and Approvals Required

List all known local, state and federal permits, approvals, certifications and financial assistance for the project. Include modifications of any existing permits, governmental review of plans and all direct and indirect forms of public financial assistance including bond guarantees, Tax Increment Financing and infrastructure. All of these final decisions are prohibited until all appropriate environmental review has been completed. (See Minnesota Rules, Chapter 4410.3100.)

Table 6 lists the permits and approvals required for the project. There are no forms of public financial assistance, including bond guarantees, tax increment financing and infrastructure associated with the project.

Table 6 Required Permits

Unit of Government	Type of Application
MPCA	Title V Permit Amendment
DNR	Water Appropriation Permit
Commission	Minor Alteration

10. Land Use

(a)i. Describe existing land use of the site as well as areas adjacent to and near the site, including parks and open space, cemeteries, trails, prime or unique farmlands.

The project is within an existing industrial facility. Adjacent land use includes farmland to the north, south and east, and railroad, 349th Avenue, and State Highway 65 to the west. A small rural subdivision is southwest.

The nearest park is the Sandquist Family Park located about one mile southeast of the facility. Purple Hawk Country Club golf course is about one and one-half miles to the north. The Isanti County Fairgrounds are one and two-third miles to the south-southeast. Cambridge-Isanti High School is a similar distance to the southwest. Cambridge Lutheran Church cemetery is adjacent to the east side of the high school. There are no recreational trails immediately adjacent to the facility, but the Rum River State Water Trail is about one mile to the west. Farmlands of statewide importance meander through the project area.

Figure 1 Sandquist Family Park

Source: Google Earth

(a)ii. Describe planned land use as identified in comprehensive plan (if available) and any other applicable plan for land use, water, or resources management by a local, regional, state, or federal agency.

The facility is about three miles north of Cambridge in unincorporated Isanti County. According to the Isanti County Comprehensive Plan, land use in the county is predominantly rural, and agriculture is the dominant land use.[15] The county has three major urban areas, Cambridge (three miles south), Isanti (nine miles south), and Braham (10 miles north).[16] The County Plan "proposes changes that will retain the importance of County urban areas, will promote growth and development that is responsive to the efforts of city planning such as investments in commercial and industrial areas and will promote adjacent agricultural area development in manners respective of County and city planning and transportation efforts."[17]

(a)iii. Describe zoning, including special districts or overlays such as shoreland, floodplain, wild and scenic rivers, critical area, agricultural preserves, etc.

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[15] Biko Associates (February 5, 200) *Isanti County, Minnesota: Comprehensive Plan*, retrieved from: https://www.co.isanti.mn.us/DocumentCenter/View/456/Isanti-County-Comprehensive-Plan-PDF?bidId=, at 12, 14.

[16] *Id*. at 30.

[17] *Ibid*.

According to the Isanti County Zoning District, the facility is in an Agriculture/Residential District (Map 6).[18] Anyone building in these areas must accept the rural environment as it is found. This district is intended to provide the following uses:

- Allow suitable areas of the County to be retained in agricultural use
- Prevent scattered, non-farm development
- Secure economy in governmental expenditures for public services, utilities, and schools.

The Shoreland District, a Special Protection Subdistrict, encompasses Rum Lake approximately one-quarter mile east of the facility. The Rum River Scenic District runs along the Rum River throughout the county. At its closest point this district is about one mile west of the facility.[19]

(a)iv. If any critical facilities (i.e. facilities necessary for public health and safety, those storing hazardous materials, or those with housing occupants who may be insufficiently mobile) are proposed in floodplain areas and other areas identified as at risk for localized flooding, describe the risk potential considering changing precipitation and event intensity.

The facility is outside of floodplains or areas with localized flooding potential.

b. Discuss the project's compatibility with nearby land uses, zoning, and plans listed in Item 9a above, concentrating on implications for environmental effects.

The project and its activities (excluding fuel deliveries) are within an existing industrial facility on GRE-owned property. The project will not change existing land use or zoning. The facility is surrounded by agriculture with some residential housing; however, given it has been in operation for nearly twenty years the project is not expected to significantly change the character of the surrounding landscape.

c. Identify measures incorporated into the proposed project to mitigate any potential incompatibility as discussed in Item 10b above and any risk potential.

The project is expected to be compatible with local land use and zoning ordinances; therefore, mitigation is not proposed.

11. Geology, Soils and Topography/Land Forms

a. Geology - Describe the geology underlying the project area and identify and map any susceptible geologic features such as sinkholes, shallow limestone formations, unconfined/shallow aquifers, or karst conditions. Discuss any limitations of these features for the project and any effects the project could have on these features. Identify any project designs or mitigation measures to address effects to geologic features.

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[18] Isanti County (December 29, 2014) *Isanti County Zoning Ordinance*, retrieved from: https://www.co.isanti.mn.us/DocumentCenter/View/450/Isanti-County-Zoning-Ordinance---2014-PDF.

[19] Beacon (n.d.) *Isanti County Geographic Information Systems Online Portal*, retrieved from: https://www.co.isanti.mn.us/175/Geographic-Information-Systems-GIS.

The facility is located within the Anoka Sand Plain region. According to regional well logs, it is underlain by approximately 100 feet of unconsolidated sediments.[20] Pleistocene-aged lake sediments associated with the Grantsburg sublobe of the Des Moines lobe are directly beneath the site. They consist primarily of very fine to medium sand with minor amounts of silt. These unconsolidated sediments are underlain by Cambrian-aged sedimentary rocks. There are no known springs, karst, or sinkholes near the facility.[21]

b. Soils and topography - Describe the soils on the site, giving NRCS (SCS) classifications and descriptions, including limitations of soils. Describe topography, any special site conditions relating to erosion potential, soil stability or other soils limitations, such as steep slopes, highly permeable soils. Provide estimated volume and acreage of soil excavation and/or grading. Discuss impacts from project activities (distinguish between construction and operational activities) related to soils and topography. Identify measures during and after project construction to address soil limitations including stabilization, soil corrections or other measures. Erosion/sedimentation control related to stormwater runoff should be addressed in response to Item 12.b.ii.

The Soil Survey of Isanti County[22] indicated soils at the facility are Anoka and Lino loamy fine sands. The Anoka and Lino series are nearly level to gently sloping and formed in outwash plains. Soils can be poorly drained due to the profile of loamy sand over fine sands. The Anoka and Lino soils have low susceptibility to sheet and rill erosion by water. There are no concerns regarding soil stability or excessive erosion at the facility. Neither the Anoka nor Lino soils are classified as prime farmland; however, the Anoka soil is classified as farmland of statewide importance.

The topography within the facility has a gradual slope with an east facing aspect. The lowest elevation in the project area is 936 feet above mean sea level (amsl) along the eastern fence line and a high of 950 feet amsl along the western fence line. Topography has been altered from previous construction and grading (**Figure 2**).

Figure 2 Cambridge Station (2006)

Source: Google Earth

Construction would result in less than one acre (0.46 acres) of surface disturbance, and would result in approximately 800 cubic yards of material being excavated. GRE indicates soils will be staged south and west of the new ULSD AST. Any excavated soils will be seeded and monitored for erosion until stabilized.

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[20] Minnesota Department of Health (September 7, 2022) *Minnesota Well Index (MWI)*, retrieved from: https://mnwellindex.web.health.state.mn.us/.

[21] Minnesota Department of Natural Resources (n.d.) *Karst Features Inventory*, retrieved from: https://arcgis.dnr.state.mn.us/portal/apps/webappviewer/index.html?id=9df792d8f86546f2aafc98b3e31adb62.

[22] Natural Resources Conservation Service (July 31, 2022) *Farmland Classification – Isanti County, Minnesota*, retrieved from: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

This soil might also be used for the energy storage project to provide a berm on the south, which will help convey stormwater to the existing ditch on the north and ultimately to the retention basin.

Soils outside of the facility fence line will not be directly impacted by the project.

12. Water Resources

(a)i. Describe surface water on or near the site—lakes, streams, wetlands, intermittent channels, and county/judicial ditches. Include any special designations such as public waters, shoreland classification and floodway/floodplain, trout stream/lake, wildlife lakes, migratory waterfowl feeding/resting lake, and outstanding resource value water. Include the presence of aquatic invasive species and the water quality impairments or special designations listed on the current MPCA 303d Impaired Waters List that are within 1 mile of the project. Include DNR Public Waters Inventory number(s), if any.

The facility is within the Upper Mississippi River Basin, Rum River Watershed (HUC 8: 07010207). There are no lakes, streams, wetlands, or intermittent channels within the facility.

The nearest public water to the facility is the Rum River, approximately 1.3 miles west. The Pollution Control Agency (MPCA) identified this stretch of the Rum River (AUID: 07010207-504) as impaired for aquatic consumption due to high levels of mercury in fish tissue.[23] A Total Maximum Daily Load study (PRJ07770-001) was approved by the U.S. Environmental Protection Agency (EPA) in 2008. This study was used to calculate the maximum amount of a pollutant a waterbody can receive, and established limits on point and non-point sources of pollution. Nevertheless, this stretch of river remains impaired.

There are three public water inventory basins within one mile of the facility:

- Unnamed wetland basin (30-49W) approximately 350 feet southeast
- Rum Lake (30-48P) is approximately three-quarter miles east
- Unnamed wetland basin (30-200W) approximately one mile northeast

No other surface waters, such as lakes, wildlife lakes, migratory waterfowl lake, or outstanding resource value waters are within one mile of the project area. **Map 7** shows all wetlands within a one-mile buffer of the facility.

(a)ii. Describe groundwater on or near the site—aquifers, springs, seeps. Include: 1) depth to groundwater; 2) if project is within a MDH wellhead protection area; 3) identification of any onsite and/or nearby wells, including unique numbers and well logs if available. If there are no wells known on site or nearby, explain the methodology used to determine this.

The facility is not within a wellhead protection area, the nearest being 1 mile southeast. According to the Department of Health's (MDH) County Well Index, there are two production wells utilized by GRE within the project area: 731142 and 731143.[24] There are also several domestic wells within 1 mile.

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[23] Minnesota Pollution Control Agency (April 29, 2022) *2022 Minnesota's Impaired Waters*, retrieved from: https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list.

[24] *Supra* note 19.

The depth to the water table ranges from zero to 10 feet within the facility.[25] In the construction area, the groundwater table is at an elevation between 931.5 feet to 933 feet asml, which is at least 10 feet below grade at the highest point.[26] Pipe trenches are expected to be at least three to five feet above these levels.

b. Describe effects from project activities on water resources and measures to minimize or mitigate the effects in Item b.i. through Item b.iv. below.

i. Wastewater - For each of the following, describe the sources, quantities and composition of all sanitary, municipal/domestic and industrial wastewater produced or treated at the site.

1) If the wastewater discharge is to a publicly owned treatment facility, identify any pretreatment measures and the ability of the facility to handle the added water and waste loadings, including any effects on, or required expansion of, municipal wastewater infrastructure.

The project will not generate wastewater. GRE plans to periodically contract a mobile RO system, which will use groundwater to create demineralized water for ULSD combustion. The demineralized water will be completely evaporated as part of combustion. The mobile system occasionally backflushes the RO filters but does not generate wastewater. Instead, filters eventually clog and are disposed off-site by the RO system contractor. This mobile RO system can operate, if needed, during a polar vortex.

Processed wastewater from evaporative cooler blowdown, necessary at times when burning natural gas, is periodically discharged to the retention basin, after being sampled according to a MPCA issued NPDES wastewater permit MN0068098.

2) If the wastewater discharge is to a subsurface sewage treatment systems (SSTS), describe the system used, the design flow, and suitability of site conditions for such a system. If septic systems are part of the project, describe the availability of septage disposal options within the region to handle the ongoing amounts generated as a result of the project. Consider the effects of current Minnesota climate trends and anticipated changes in rainfall frequency, intensity and amount with this discussion.

Not applicable. The project will not discharge wastewater into a subsurface sewage treatment system.

3) If the wastewater discharge is to surface water, identify the wastewater treatment methods and identify discharge points and proposed effluent limitations to mitigate impacts. Discuss any effects to surface or groundwater from wastewater discharges, taking into consideration how current Minnesota climate trends and anticipated climate change in the general location of the project may influence the effects.

Stormwater is discharged via ditches and collected in a retention basin. Surface water runoff from un-diked areas of the facility flows primarily overland to the eastern sides of the facility, which then flows into the retention basin (Map 4). There is an inlet culvert into the northwest corner of the basin to convey

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[25] Adams, Roberta. Water-Table Elevation (Atlas HG-03, Plate 1 of 2). S.I.: Minnesota Department of Natural Resources, 2016.

[26] *Supra* note 4.

stormwater from the western side of the facility. GRE points out the basin has functioned well as a volume control system since its construction and is capable of capturing water amounts greater than a 10-year, 24-hour storm event without discharging to the adjacent wetland. As one recent example, on August 17, 2022, Cambridge received 5 inches of rain in 2 hours. Afterward, the retention basin was observed with less than 10 inches of standing water on the southern end. The project would not increase the amount of wastewater discharged to the existing retention basin.

ii. Stormwater - Describe changes in surface hydrology resulting from change of land cover. Describe the routes and receiving water bodies for runoff from the project site (major downstream water bodies as well as the immediate receiving waters). Discuss environmental effects from stormwater discharges on receiving waters post construction including how the project will affect runoff volume, discharge rate and change in pollutants. Consider the effects of current Minnesota climate trends and anticipated changes in rainfall frequency, intensity and amount with this discussion. For projects requiring NPDES/SDS Construction Stormwater permit coverage, state the total number of acres that will be disturbed by the project and describe the stormwater pollution prevention plan (SWPPP), including specific best management practices to address soil erosion and sedimentation during and after project construction. Discuss permanent stormwater management plans, including methods of achieving volume reduction to restore or maintain the natural hydrology of the site using green infrastructure practices or other stormwater management practices. Identify any receiving waters that have construction-related water impairments or are classified as special as defined in the Construction Stormwater permit. Describe additional requirements for special and/or impaired waters.

Construction Stormwater

Project construction would result in less than one acre (0.46 acres) of surface disturbance. As a result, a construction stormwater permit from MPCA would not be required. GRE would, however, implement Best Management Practices (BMPs) to prevent stormwater runoff and sediment accumulation in the facility retention basin. The selected contractor would install erosion and sedimentation BMPs prior to ground disturbing activities around the ASTs, pipe trenches, and building addition.

GRE points out that specific attention will be paid to BMPs around the ULSD AST as soils could migrate off the construction site during a significant rain event if not properly managed. Regular inspections of the construction area would confirm containment of sediment and minimize migration into the facility retention basin or off site. BMPs such as silt fence and straw wattles will be installed according to manufacturer specifications. GRE states these BMP efforts exceed NDPES construction site requirements.

There is an outlet valve that can be opened to release stormwater from the retention basin to the wetland to the south (**Map 4**). This outlet valve is kept closed and locked. The wetland drains to the southwest, eventually into the Rum River. Since the facility retention basin would ultimately control any erosion from construction, most runoff risk would be mitigated.

Operational Stormwater

Stormwater runoff flow volumes from the project are not anticipated to increase significantly from current conditions because impervious surface areas would only increase by 0.14 acres. Further, the existing retention basin was designed to be oversized during the original construction of Unit 2 CT based on the amount of impervious surfaces at that time. According to plant staff, they periodically inspect the closed outlet valve and have no recollection or historical records of ever draining the basin, even after the largest rain events experienced at the facility. For example, a basin inspection the morning after a 10-year rain event revealed approximately 10 inches of water on the south end, far below the basin's five-foot lateral capacity.

Climate driven impacts were discussed in Item 7. This section pointed out that the retention basin is unlikely to entirely contain contents from a 100-year or 500-year storm event, which are predicted to increase in intensity and frequency due to climate change.

iii. Water appropriation - Describe if the project proposes to appropriate surface or groundwater (including dewatering). Describe the source, quantity, duration, use and purpose of the water use and if a DNR water appropriation permit is required. Describe any well abandonment. If connecting to an existing municipal water supply, identify the wells to be used as a water source and any effects on, or required expansion of, municipal water infrastructure. Discuss environmental effects from water appropriation, including an assessment of the water resources available for appropriation. Discuss how the proposed water use is resilient in the event of changes in total precipitation, large precipitation events, drought, increased temperatures, variable surface water flows and elevations, and longer growing seasons. Identify any measures to avoid, minimize, or mitigate environmental effects from the water appropriation. Describe contingency plans should the appropriation volume increase beyond infrastructure capacity or water supply for the project diminish in quantity or quality, such as reuse of water, connections with another water source, or emergency connections.

GRE evaluated groundwater depths within the construction area. Groundwater is greater than five feet below the surface elevation. Therefore, temporary dewatering is not expected to be necessary to install the ULSD AST or the underground ULSD and demineralized water pipes. The DNR requires a water appropriation permit for projects withdrawing more than 10,000 gallons of water per day or one million gallons per year. As a contingency, GRE would apply for a water appropriation general permit (1997-0005) from the Minnesota DNR if groundwater is encountered and dewatering becomes necessary.

For periodic Unit 2 CT evaporative cooling, the facility has an individual water appropriation permit (Permit ID 2007-0405). The permit is in the process of being amended to include groundwater use for demineralization associated with water injection for NO_X combustion control. Currently, the permit allows for the appropriation of 10 million gallons per year for use at the facility. In 2021, GRE used approximately one million of the 10 million gallons allotted through their individual water appropriations permit. It is estimated that the project could require approximately 300,000 to 950,000 more gallons of groundwater per year in the operating Scenarios 1 and 2, respectively. Use would depend on the frequency and duration of natural gas curtailment. Table 7 lists the additional annual water usage expected for the project based on operating scenario.

Table 7 Water Usage Firing ULSD

Hourly Water Use in Gallons[1]	Operating Scenario	Hours per Year	Annual Water Use in Gallons
12,760 gallons per hour	Scenario 1	24	306,000
	Scenario 2	75	957,000
	Scenario 3	1,282	17,443,000

[1] Water gallons per hour based on water to fuel oil injection ratio of 1:1 by weight. Fuel usage based on 2021 estimated V84.3A(2) gas turbine performance for unit operating at baseload at -20°F ambient temperature with water injection on. Injection ratios are estimated and may be

adjusted during plant commissioning to meet emissions. Performance will be adjusted to the actual injection rate.

The facility depends on the available groundwater supply. GRE operates two wells on-site. These wells are 310 and 340 feet deep. The applicant states that because the DNR water appropriations permit already allows for this increase, contingency plans beyond established regulatory limits are not needed. If groundwater supplied from GRE's existing wells became unavailable, GRE indicates it would assess drilling a deeper well or potentially hauling water.

iv. Surface Waters

a) Wetlands - Describe any anticipated physical effects or alterations to wetland features such as draining, filling, permanent inundation, dredging and vegetative removal. Discuss direct and indirect environmental effects from physical modification of wetlands, including the anticipated effects that any proposed wetland alterations may have to the host watershed, taking into consideration how current Minnesota climate trends and anticipated climate change in the general location of the project may influence the effects. Identify measures to avoid (e.g., available alternatives that were considered), minimize, or mitigate environmental effects to wetlands. Discuss whether any required compensatory wetland mitigation for unavoidable wetland impacts will occur in the same minor or major watershed and identify those probable locations.

No wetland features or natural surface waters are within the facility fence line. There will be no direct physical effects or alterations to wetlands as part of the project.

There is a large wetland complex southeast of the facility (**Map 7**). According to the U.S. Fish and Wildlife Service (FWS) National Wetland Inventory (NWI) this wetland spans approximately 48 acres and is classified as a freshwater shrub/emergent wetland. This wetland is also classified as a DNR Public Water. Based on a review of aerial imagery the wetland is largely vegetated with emergent herbaceous vegetation with few open water areas. The wetland outlets to the southwest where it ultimately drains into the Rum River. The project is not expected to directly impact this wetland area.

The facility's retention basin is expected to manage most stormwater. As stated previously, the basin can handle a 10-year rain event. Should the outlet valve need to be opened when the adjacent wetland is not at flood stage, water would drain to the adjacent wetland. The wetland would absorb more stormwater than the retention basin. In combination, the basin and the wetland would be expected to reduce the intensity of stormwater runoff, nutrient loading, localized flooding, and other related effects.

While the facility's retention basin is expected to manage most stormwater, the basin is not designed to hold a 100-year or 500-year rain event. Storm events of this intensity are unlikely but are predicted to increase because of climate change. If an event of this magnitude were to occur, the basin would not be able to contain all the stormwater from the facility.

According to the DNR, the 100-year rain event is about six to seven inches in 24 hours. Stormwater is modeled to overtop the retention basin's outfall during a 100-year rain event. While the 500-year rain event has not been modeled, it would also overtop the outfall. If the adjacent wetland is at flood stage or above the retention basin outlet stormwater cannot gravity flow from the outlet valve at the bottom of the retention basin. Water would be retained until it eventually overtops the outfall. At this point, the retention basis would not provide any benefit as containments would not be able to settle out prior to reaching the adjacent wetland. If this were to occur some of the facility's stormwater would be expected to drain to the Rum River. Additionally, water flows and channel erosion might increase in the event the basin overflows.

GRE did not consider measures to avoid, minimize, or mitigate these risks to wetlands as they are in compliance with current regulations and have not experienced overloading issues in their retention basin to date. The increase in impervious surfaces and changes in surface hydrology from this project in contribution to the Rum River watershed is negligible.

b) Other surface waters- Describe any anticipated physical effects or alterations to surface water features (lakes, streams, ponds, intermittent channels, county/judicial ditches) such as draining, filling, permanent inundation, dredging, diking, stream diversion, impoundment, aquatic plant removal and riparian alteration. Discuss direct and indirect environmental effects from physical modification of water features, taking into consideration how current Minnesota climate trends and anticipated climate change in the general location of the project may influence the effects. Identify measures to avoid, minimize, or mitigate environmental effects to surface water features, including in-water Best Management Practices that are proposed to avoid or minimize turbidity/sedimentation while physically altering the water features. Discuss how the project will change the number or type of watercraft on any water body, including current and projected watercraft usage.

Not applicable. The project does not alter surface waters.

13. Contamination/Hazardous Materials/Wastes

a. Pre-project site conditions - Describe existing contamination or potential environmental hazards on or in close proximity to the project site such as soil or ground water contamination, abandoned dumps, closed landfills, existing or abandoned storage tanks, and hazardous liquid or gas pipelines. Discuss any potential environmental effects from pre-project site conditions that would be caused or exacerbated by project construction and operation. Identify measures to avoid, minimize or mitigate adverse effects from existing contamination or potential environmental hazards. Include development of a Contingency Plan or Response Action Plan.

The facility has been used for electrical generation for over 50 years. There are aboveground pipelines connecting Unit 1 CT to its ULSD AST. Unit 2 CT was added to the facility in 2006. Natural gas lines were installed to Unit 2 CT in the general location where the new ULSD lines will run. The project area was reworked in 2006 as part of Unit 2 CT construction. At that time, soil was moved from the retention basin to the area where the new AST would be built. No contamination was found during these site construction activities. Therefore, contamination concerns in the project area are not expected.

Gopher State One Call will be contacted to identify buried utilities. Existing underground natural gas lines and other buried utilities will be avoided during construction. A hydrovac truck will be used in these areas to avoid potential damage. Hand excavations will be used if hydrovacing is unsuccessful. "Hydrovacing is a process that uses high pressure water to cut the soil and a vacuum truck to remove the slurry to make a trench."[27]

MPCA's *What's in my Neighborhood* lists facilities with permits and sites which might be current or historical sources of contamination. There are no nearby sites that are expected to interfere with the project as most are over a mile away and do not share the same potential for environmental effects. For example, most nearby sites simply have MPCA hazardous waste or stormwater permits, and all nearby investigation and cleanup sites are inactive. The nearest facility is about one-third mile southwest of the facility and is listed for its hazardous waste license.

The facility has an SPCC plan, spill response materials and trained staff to respond to spills. These existing capabilities provide spill risk mitigation for the project.

b. Project related generation/storage of solid wastes - Describe solid wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from solid waste handling, storage and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of solid waste including source reduction and recycling.

Project construction includes replacement of Unit 2 CT burners, fabrication of two ASTs, welding of ULSD and demineralized water pipes, and installation of pumps/controls inside a building addition. Solid wastes associated with construction include a variety of materials, for example, construction debris, wood pallets, cardboard, plastic packaging, unused tank coatings and scrap metal. Solid wastes associated with operation will be minimal and are expected to be similar in nature, quantity, and handling to current facility operations. Wastes might include spill response materials, dead batteries from handheld equipment, and used oil/greases. Disposal of any solid wastes from construction and operation will be in accordance with state and local requirements, as well as GRE's Waste Management Plan.

c. Project related use/storage of hazardous materials - Describe chemicals/hazardous materials used/stored during construction and/or operation of the project including method of storage. Indicate the number, location and size of any new above or below ground tanks to store petroleum or other materials. Indicate the number, location, size and age of existing tanks on the property that the project will use. Discuss potential environmental effects from accidental spill or release of hazardous materials. Identify measures to avoid, minimize or mitigate adverse effects from the use/storage of chemicals/hazardous materials including source reduction and recycling. Include development of a spill prevention plan.

The project will install an additional 500,000-gallon ULSD AST for Unit 2 CT. Underground pipe from the new ULSD AST will be connected to the Unit 2 CT via the pumphouse addition (Map 1). The existing site SPCC plan will be updated as necessary. GRE maintains a 24-hour spill response program and has a contract with Bay West for emergency spill response that cannot be safely addressed by plant staff.

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[27] Wisconsin Department of Natural Resources (June 29, 2018) *Dewatering Operations Permit Fact Sheet*, retrieved from: https://dnr.wi.gov/topic/Wastewater/documents/WI0049344FS.pdf.

When there is no one at the facility, as on weekends or overnight, the facility's critical equipment (ASTs, underground wash water tank, oil/water separator, pump rooms, lube oil systems, etc.) is continuously monitored by the system operations control room in Elk River, Minnesota. Alarms on this equipment would alert operators—and GRE System Operations—of a potential spill. The pump rooms have leak detection lines on the ground, which would also trigger an alarm. The other critical equipment listed also have leak alarms. Facility staff perform monthly visual inspections of all bulk storage containers, oil-filled electrical equipment, secondary containment, and emergency response equipment. Should a spill occur, it will be cleaned up and disposed of in accordance with the facility's SPCC plan and MPCA Hazardous Waste License MND022737340. GRE is currently and will remain a minimal quantity generator after the project, generating less than 100 pounds of non-acute hazardous waste per year.

In the event of a breach of both the primary and secondary ULSD AST containments, the same guidelines and spill response practices would be followed at the facility as with other GRE properties. Spill response protocols indicate immediate notification of GRE's Security Operations Center, which receives information including the date, time, and location of the event, as well as the personal information of the reporting party. The material spilled and media affected is noted in addition to the estimated quantity and cause of the spill. Local emergency 911 services (in this case the Cambridge) are notified if there is an immediate risk of fire or explosion. Finally, GRE will notify any state agencies (for example, MPCA) as required under permits and applicable law.

Following the notifications discussed in the previous paragraph, immediate response actions include placing absorbent booms at regular intervals in the ditch adjacent to the AST and, if needed, utilizing mechanical equipment to create a temporary dirt berm to assist in containing or directing the spill. Following stabilization of the affected area, free product and impacted stormwater in the ditch would be recovered with a vacuum truck. Free product in the retention basin would be recovered using a drum oil skimmer attached to a vacuum truck. After all free product has been recovered, spill response operations would continue in two phases. First, any stormwater remaining in the retention basin would be sampled for petroleum hydrocarbons. Based on the sample results, and in consultation with MPCA, the stormwater would then either be pumped and hauled to a disposal outlet/treatment system if contaminated or discharged through the basin outfall if clean. Second, impacted soil would also be sampled for petroleum hydrocarbons, removed via mechanical or vacuum excavation, and properly disposed. Samples would be collected to confirm the extent of the release has been addressed and the impacted area has been cleaned pursuant to any MPCA guidance or input.

Potential impacts would be expected to be limited to soil contamination in the immediate area and the stormwater retention basin unless the spill coincided with a 100- or 500- year flood event. While the probability of such an event occurring is *extremely low*, in such a scenario contamination would reach the adjacent wetland.

Hazardous materials from construction and operation, such as tank coatings, spill response materials, dead batteries, and used oil/grease, will be stored in totes with secondary containment inside of facility's existing warehouse.

d. Project related generation/storage of hazardous wastes - Describe hazardous wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from hazardous waste handling, storage, and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of hazardous waste including source reduction and recycling

Aside from unused tank coatings, which will be hauled off-site by the contractor, the project is not expected to generate or introduce new hazardous wastes. Contaminated materials are not expected to be encountered as part of the project. As applicable, any unused tank coatings will be stored inside the facility warehouse with secondary containment, until hauled off site.

14. Fish, Wildlife, Plant Communities, and Sensitive Ecological Resources (Rare Features)

a. Describe fish and wildlife resources as well as habitats and vegetation on or in near the site.

The facility is on the Anoka Sandplain landform. Prior to European contact, vegetation primarily consisted of oak savanna (oak openings and oak barrens) on upland areas and river bottom forest adjacent to the Rum River at lower elevations. Near the facility, most of the native vegetation has been converted to agricultural uses.

There are some remnants of pre-European contact vegetation indicated by the Minnesota County Biological Survey (MCBS) to the west across State Highway 65.[28] This area is known as the North Cambridge Swamp. It is about 2,000 feet northwest of the facility and has a MCBS ranking of "high," which means the site contains "very good quality occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes." North Cambridge Swamp consists of tamarack swamp and mixed hardwood swamps. There is also a small area of mesic oak forest adjacent to the swamps on the upland areas. This area, along with the Rum River, are the closest "natural" habitats to the facility. The area around the Rum River might contain more diverse aquatic and terrestrial habitats.

More generally, however, wildlife habitat in the area is disturbed open land habitat dominated by agricultural fields. Fallow fields, fencerows, and woodlots throughout the area provide habitat for terrestrial and avian wildlife.

The southern portion of the facility has been planted with a native seed mix. It provides prairie habitat for commonly occurring species such as migratory songbirds; insects; and small mammals such as voles, mice, shrews. This prairie area is contained within the fence line and, as such, is not generally accessible to medium to large mammals such as snowshoe hare, white-tailed deer, bear, or coyotes.

The existing retention basin might provide habitat to amphibians, reptiles, and migratory birds when inundated. However, due to the variability in water elevations, it is unlikely for the retention basin to be utilized for nesting or breeding. This area is also within the fence line meaning medium to large mammals are generally excluded from the basin.

Wildlife species utilizing the area are adapted to agriculture and developed landscapes. Terrestrial wildlife species near the facility are expected to be common species associated with disturbed habitats and are accustomed to human activities occurring in the area, for example, agricultural activities and road traffic.

b. Describe rare features such as state-listed (endangered, threatened or special concern) species, native plant communities, Minnesota Biological Survey Sites of Biodiversity Significance, and other

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[28] Delaney, Barbara and Epp, Al. Natural Communities and Rare Species in Isanti County, Minnesota. S.l.: Minnesota Department of Natural Resources, 1993. Minnesota County Biological Survey Map Series: No 6.

sensitive ecological resources on or within close proximity to the site. Provide the license agreement number and/or correspondence number from which the data were obtained and attach the Natural Heritage Review letter from the DNR. Indicate if any additional habitat or species survey work has been conducted within the site and describe the results.

State Listed Species

GRE retained Barr Engineering for contracting services. Barr Engineering has a license agreement (LA-898) with the DNR for access to the Natural Heritage Information System (NHIS) database, which was queried in August 2022 to identify rare species that might exist near the facility. The NHIS database indicates that four rare species have been documented within one mile of the project.

The DNR completed a NHIS review of the project on February 10, 2023 (MCE 2022-00841). The review was completed to determine if the project has potential to impact rare species or other significant natural resources. Based on the project details, the DNR identified one species that may be impacted by the project: the Blanding's turtle (*Emydoidea blandingii*). The Blanding's turtle has been reported in the vicinity of the facility and might be encountered in the construction area.

The Blanding's turtle (*Emydoidea blandingii*) is a state listed threatened species. Blanding's turtles are found in wetland complexes and adjacent sandy uplands. Calm, shallow waters, including wetlands associated with rivers and streams with rich aquatic vegetation are especially preferred.[29] There is no suitable natural habitat for the Blanding's turtle within the facility. There is one constructed retention basin within the facility fence line. It is unlikely for the Blanding's turtle to inhabit this area due to its artificial nature, variable water levels, and fenced location. More suitable habitat for this species might be present in the adjacent wetland complex.

Other state listed species in the general area include:

The Ram's Head Orchid (*Cypripedium arietinum*) is a state listed threatened species. Ram's head orchids are found in coniferous forest habitats. Several populations occur in swamps, bogs, or lowland forests dominated by northern white cedar, tamarack, balsam fir, or black spruce. No suitable habitat is found within the facility.

Bog bluegrass (*Poa paludigena*) is a state listed threatened species. It occurs only in wetland habitats that are maintained by groundwater seeps. These may include swamps, sedge meadows, margins of small pools, or rivulets of water. Such areas are often dominated by black ash, yellow birch, and speckled alder.[30] The retention basin contains emergent hydric vegetation; however, it is dominated by introduced species such as reed canary grass. Thus, it would not be considered suitable habitat for bog bluegrass. Suitable habitat for this species might be present in the adjacent wetland complex.

American water-pennywort (*Hydrocotyle americana*) is a state listed species of special concern. American water-pennywort is a wetland species restricted to a rather narrow range of habitat types in the east

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[29] Minnesota Department of Natural Resources (n.d.) *Emydoidea blandingii – Blanding's Turtle*, retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ARAAD04010.

[30] Minnesota Department of Natural Resources (n.d.) *Poa paludigena – Bog Bluegrass*, retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PMPOA4Z1W0.

central, and possibly the southeast, parts of Minnesota. Most occurrences are at the wet margins of small, cold, groundwater streams that emerge from small ravines within larger river valleys.[31] No suitable habitat is present within the facility. Suitable habitat for this species may be present in the adjacent wetland complex.

Federally Listed Species

The FWS Information, Planning, and Conservation System website identifies two federally listed species and one candidate species as potentially occurring near the facility.[32] The federally endangered northern long-eared bat (*Myotis septentrionalis*); the federally threatened gray wolf (*Canis lupus*), and the monarch butterfly (*Danaus plexippus*). The monarch butterfly is a candidate species and is not legally protected under the Endangered Species Act.

The northern long-eared bat inhabits caves, mines, and forests.[33] According to the DNR, the nearest northern long-eared bat roost tree is in Athens Township, Isanti County.[34] The nearest hibernacula is over 25 miles southwest of the facility near Big Lake. There are no trees within the facility.

Gray wolves occupy a wide range of habitats where large ungulates, including elk, white-tailed deer, mule deer, or moose are found. In Midwestern states, habitats currently used by wolves range from mixed hardwood-coniferous forests in wilderness and sparsely settled areas, to forest and prairie landscapes dominated by agricultural and pasture lands. Home range sizes of wolves vary, depending on prey density and pack size. In Minnesota, winter home ranges average 30 to 59 square miles. Gray wolves tend to avoid human activities and would likely avoid the facility. In addition, the facility is fenced, which would exclude gray wolves from accessing the project area.

Monarch butterflies inhabit fields, roadside areas, wet areas, or urban gardens. Monarch butterflies rely on milkweed as a food source for their larval form. Without milkweed, the larva is not be able to develop into a butterfly. Adult monarch butterflies feed on the nectar of other flowering forbs during their flight period, but only breed where milkweed is found. The southern portion of the facility was planted with a native seed mix in 2007 following construction of Unit 2 CT. According to GRE, the facility prairie does not have much, if any, milkweed for monarch hatching habitat. Suitable nectaring habitat is present.

MBS native plant communities, Sites of Biodiversity Significance, or DNR Scientific and Natural Areas do not exist within the facility.

c. Discuss how the identified fish, wildlife, plant communities, rare features and ecosystems may be affected by the project including how current Minnesota climate trends and anticipated climate

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[31] Minnesota Department of Natural Resources (n.d.) *Hydrocotyle americana – American Water-pennywart*, retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PDAPI16010.

[32] U.S. Fish and Wildlife Service (n.d.) *IPaC Information for Planning Consultation*, retrieved from: https://ipac.ecosphere.fws.gov/.

[33] Minnesota Department of Natural Resources (n.d.) *Myotis septentrionalis – Northern Long-eared Bat*, retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01150.

[34] Minnesota Department of Natural Resources (June 7, 2021) *Townships Containing Documented NLEB Maternity Roost Trees and/or Hibernacula Entrances in Minnesota*, retrieved from: https://files.dnr.state.mn.us/eco/ereview/minnesota_nleb_township_list_and_map.pdf.

change in the general location of the project may influence the effects. Include a discussion on introduction and spread of invasive species from the project construction and operation. Separately discuss effects to known threatened and endangered species.

The project will remove about 6,500 square feet of planted prairie and replace it with impervious surface. Potential impacts to wildlife and their habitats are expected to be negligible to minimal on a landscape scale given the size of the area impacted, it's location within an existing fence, and its proximity to an industrial facility. Impacts to wildlife and their habitats are not expected to occur outside the facility fence line. Impacts to rare plant communities or wildlife species should not occur.

d. Identify measures that will be taken to avoid, minimize, or mitigate the adverse effects to fish, wildlife, plant communities, ecosystems, and sensitive ecological resources.

To avoid and minimize project-related impacts on the Blanding's Turtle, GRE will implement erosion control measures to avoid indirect impacts on the adjacent wetlands. GRE will use erosion control blankets with bio-netting or natural netting. GRE will also review mulch products and will not allow any materials with synthetic (plastic) fiber additives. In addition, GRE will distribute a Blanding's Turtle information flyer to all contractors working on site. Any turtles found on site in imminent danger will be moved by hand out of harm's way, otherwise, they will be left undisturbed.

In addition, stormwater and waste management mitigation measures would help mitigate impacts to all species. These impacts were discussed in Item 12. During project construction, implementing stormwater BMPs would prevent erosion to the retention basin. No additional avoidance or minimization measures are proposed.

15. Historic Properties

Describe any historic structures, archeological sites, and/or traditional cultural properties on or in close proximity to the site. Include: 1) historic designations, 2) known artifact areas, and 3) architectural features. Attach letter received from the State Historic Preservation Office (SHPO). Discuss any anticipated effects to historic properties during project construction and operation. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to historic properties.

The State Historic Preservation Office (SHPO) reviewed the project and concluded "there are no properties listed in the National or State Registers of Historic Places, and no known or suspected archaeological properties located in the area that will be affected by this project."

16. Visual

Describe any scenic views or vistas on or near the project site. Describe any project related visual effects such as vapor plumes or glare from intense lights. Discuss the potential visual effects from the project. Identify any measures to avoid, minimize, or mitigate visual effects.

The project is within an existing industrial facility. The facility is east of a major state highway and distribution line, and adjacent to an active railroad. There is a small rural neighborhood comprised of about 10 homes to the southwest (Map 8). Aerial imagery shows this neighborhood predates Unit 2 CT. The closest home is about two-tenths of a mile away from the future ULSD AST site (Map 8; Figure 3 and

Figure 4). The facility is otherwise surrounded by agricultural land and small farmsteads. There are no scenic byways near the facility.

The project is consistent with past facility operations. Neighboring landowners' viewshed to the northeast will continue to be that of an industrial facility. The height of the new ULSD and demineralized water ASTs will be lower than the facility skyline. As such, these features are expected to blend with the overall facility profile. Incremental impacts will occur but are expected to be minimal. Whether operating on natural gas or ULSD, there would continue to be vapor plumes from the Unit 2 CT during cold weather. GRE indicates the facility currently has many lights for security and safety. To reduce the visibility of the project, task lighting will be utilized instead of flood or area lighting. Lights will be shielded and directed towards the ground as much as practical.

Figure 3 Nearest Residences

Source: EERA Staff

Figure 4 Cambridge Station (2022)

Source: EERA Staff

17. Air

a. Stationary source emissions - Describe the type, sources, quantities and compositions of any emissions from stationary sources such as boilers or exhaust stacks. Include any hazardous air pollutants, criteria pollutants. Discuss effects to air quality including any sensitive receptors, human health or applicable regulatory criteria. Include a discussion of any methods used assess the project's effect on air quality and the results of that assessment. Identify pollution control equipment and other measures that will be taken to avoid, minimize, or mitigate adverse effects from stationary source emissions.

The facility has two existing combustion turbines, Unit 1 CT and Unit 2 CT, that use fuel oil and natural gas, respectively. The project will replace Unit 2 CT's existing natural gas burners with dual-fuel burners allowing it to burn natural gas or ULSD as discussed in the Section 6.b. The project will also include construction of an ULSD AST. This AST would be an air emission source of an insignificant amount of Hazardous Air Pollutants (HAP) and Volatile Organic Compounds (VOC).

The facility holds an Air Permit from the MPCA, which currently caps total NO_X emissions at 225 tpy. As described in Section 6 of this EAW, it is possible for GRE to operate under an optional alternate scenario through their Air Permit which would allow for 240 tpy of NO_x. GRE completed an Air Permit amendment for the project with the MPCA, which included detailed pollutant emission calculations. The facility will continue to operate in compliance with the same permit limits post-project.

Project Air Emissions Summary

Table 8 summarizes project emissions in pounds per hour as well as annual emissions for multiple operating scenarios (Scenarios 1 – 4). These scenarios were defined by the applicant and are discussed below. They use conservative estimates for emissions that are greater than historical data or typical operation to assess impacts by accounting for unforeseen variability. Footnotes to Table 8 provide justification for the values used in the table for calculations. Extensive detail is available in the Air Permit Technical Support Document when relevant as referenced in various footnotes.[35]

Scenario 1 represents a likely or typical ULSD annual operating assumption of 24 hours per year. It is based on annual average ULSD operation across GRE's combustion turbines with similar operating scenarios. These combustion turbines operated approximately six to 16 hours per year from 2011-2022. Natural gas represents the high end of the range of typical operating hours per year based on 2011-2022 actual hours of operation.

Scenario 2 represents a maximum annual operating assumption of 75 hours per year and is based on the maximum ULSD operating hours across GRE's combustion turbines during Winter Storm Uri in 2021. For example, GRE's Elk River Combustion Turbine, which is like Unit 2 CT, ran on ULSD for 50 hours during Winter Storm Uri. This was its highest annual ULSD operations since 2011. The assumption of 75 hours under this scenario is more conservative to account for unforeseen variability. This number was chosen to represent 3 days of operation, which is consistent with the maximum operations in Texas during the 2021 polar vortex. Natural gas represents maximum annual hours of operation based on 2011-2022 actual hours of operation.

Scenario 3 and **Scenario 4** represent the maximum hours Unit 2 CT could run on natural gas or ULSD, respectively, to reach the total facility's potential Air Permit NO_X limit of 240 tpy to evaluate the highest potential NO_x impact for the project. This is based upon the extrapolated maximum fuel usage that would result in 240 tpy of NO_x emissions. The total facility NO_X limit inherently limits other pollutants because NO_X will always be the highest pollutant regardless of Unit 2 CT's load and fuel type.

Again, GRE indicates it will not condition or limit burning ULSD beyond what it defines as a natural gas curtailment, that is, when natural gas is unavailable or ULSD is more economical than natural gas. GRE points out that the total facility is currently limited by the Air Permit to 225 tons per year of NO_X on a 12-month rolling basis, which would include ULSD fuel oil combustion.

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[35] Minnesota Pollution Control Agency (n.d.) *Understanding Environmental Justice*, retrieved from: https://mpca.maps.arcgis.com/apps/MapSeries/index.html?appid=f5bf57c8dac24404b7f8ef1717f57d00&entry=6.

Table 8 Project Air Emissions

Pollutant Category	Pollutant	Maximum Hourly Emission Rate[1]			Operating Scenarios—Hours per Year					
					Scenario 1		Scenario 2		Scenario 3	Scenario 4
					600	24	1200	75	4000	1367
		Nat Gas	ULSD	Reference	Nat Gas	ULSD	Nat Gas	ULSD	Nat Gas	ULSD
		lb/hour	lb/hour		ton/year	ton/year	ton/year	ton/year	ton/year	ton/year
Criteria Pollutants	VOC	5.60	5.80	1	1.68	0.070	3.36	0.218	11.2	3.96
	PM	8.60	30.0	1	2.58	0.360	5.16	1.13	17.2	20.5
	PM_{10}	8.60	30.0	1	2.58	0.360	5.16	1.13	17.2	20.5
	$PM_{2.5}$	3.82	23.2	6	1.15	0.279	2.29	0.870	7.63	15.9
	CO	48.6	50.9	1, 4	14.6	0.611	29.2	1.91	120	120
	SO_2	0.184	3.17	2	0.055	0.038	0.110	0.119	0.368	2.17
	H_2SO_4 Mist	0.00368	0.0634	3	0.0011	0.0008	0.0022	0.0024	0.0074	0.043
	NO_X	120	351	1	36	4.21	72	13.2	240	240
GHGs	CO_2	235,007	340,945	5	70,504	4,105	141,008	12,829	470,014	233,836
	CH_4	4.43	13.8	5	1.33	0.166	2.65	0.518	8.84	9.45
	N_2O	0.44	2.77	5	0.133	0.033	0.265	0.104	0.884	1.89
	CO_2e	235,250	342,112	5	70,521	4,105	141,042	12,829	470,500	234,635
HAPs	Total HAP	2.06	2.69	2	0.62	0.032	1.24	0.101	4.13	1.84
Above Ground ULSD Storage Tank (AST) Working Losses										
HAPs	Total HAP	--	--	7	--	--	--	--	--	0.074
Consumables										
Firing the Turbine	Consumable	lb/hour	gal/hour	Reference	--	Kgal/yr	--	Kgal/yr	--	Kgal/yr
	Fuel Usage	106,289	15,200	8	--	365	--	1,140	--	20,778
	Water Usage	106,289	12,760	9, 10	--	306	--	957	--	17,443
Transportation	--	--	Initial Fill	Reference	Refill					
	--	--	ton	--	--	ton/yr	--	ton/yr	--	ton/yr
	CO_2e	--	15	11	--	11	--	33	--	570

[1] Worst-case emission rates for Unit 2 CT (EQUI10 in the Air Permit) based on 2021/2022 information for new dual-fuel burners provided by Siemens Westinghouse for Estimated V84.3A(2) Gas Turbine Performance.

Maximum hourly emissions for EQUI10 (natural gas operation) based on unit operating at baseload at -20°F ambient temperature with evaporative cooling off. EQUI10 does not have any control equipment when operating on natural gas.

Maximum hourly emissions for EQUI10 (ULSD operation) based on unit operating at baseload at -20°F ambient temperature with water injection on. GRE will operate EQUI10 with water injection when using ULSD to mitigate NO_X emissions.

[2] EQUI10 ULSD emission factor from AP-42 Section 3.1. All sulfur in fuel is assumed to be converted to sulfur dioxide (SO_2). For natural gas, Northern Natural Gas data in the Air Permit was used.

[3] Assumes a 1-2% conversion of SO_2 to sulfur trioxide (SO_3) and, conservatively, 100% conversion of SO_3 to H_2SO_4.
(Reising, B.; Siemens-Westinghouse; Review of Air Toxics from Combustion Sources; Power Gen 2003 – Las Vegas; December 2003)

[4] For annual emissions, assume carbon monoxide (CO) is 50% of total NO_X, to account for significantly higher CO emissions during startup. CO is inherently limited by the NO_X and startup time limit of 45 minutes in the Air Permit. Based on startup and operating mode emission factors, and the relative amount of time spent in "normal" vs. "startup" operation, it is conservative to assume that overall CO emissions would be 50% of the NO_X emissions.

[5] CO_2e includes CO_2 emissions as well as methane (CH_4) and N_2O converted to CO_2e by multiplying values by their global warming potential (25 and 298, respectively)[36]. Emission Factors for CO_2, CH_4 and N_2O are from EPA 40 CFR 98 Tables C-1 and C-2, which were converted from kg CO_2/mmBtu to lb/mmBtu assuming a conversion rate of 2.20462lb/kg. The mmBtu/hr rated for the turbine used to get to the final lb/hr answer is 2,091 mmBtu/hr on ULSD and 2,009 mmBtu/hr on natural gas. See **Appendix G** for further details.

[6] EPA WebFire for particulate matter (PM) 2.5-PRI for "controlled" sources since EPA WebFire does not provide "uncontrolled" PM 2.5 emission factor.

[7] AST emissions calculated using MPCA's Estimating Air Emissions from Vertical Fixed Roof Storage Tanks (aq6-15) following AP-42 Chapter 7. Total throughput gallons (129,735,600 gallons/year) based on ULSD firing 8,760 hours/year with a burner capacity of 2,091 mmBtu/hour.

[8] Gallons per hour based on a typical ULSD weight of 7 pounds per gallon. Fuel usage based on 2021 Estimated V84.3A(2) Gas Turbine Performance for unit operating at baseload at -20°F ambient temperature with water injection on.

[9] Water gallons per hour based on water to fuel oil injection ratio of 1:1 by weight. Injection ratios are estimated and may be adjusted during plant commissioning to meet emission limits. Performance will be adjusted to the actual injection rate.

[10] GRE Cambridge's DNR Groundwater Appropriations Permit allows withdrawal of 10 million gallons per year.

[11] Emissions represent haul truck fuel usage for tank filling only. Calculated assuming a 7,500 gallon tanker truck, round trip to Rosemount Minnesota, and 7.3 miles per gallon. CO_2e calculated using EPA's Simplified GHG Emissions Calculator.

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[36] U.S. Environmental Protection Agency (n.d.) *Understanding Global Warming Potentials*, retrieved from: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

As shown in **Table 8**, firing ULSD would create more SO_2, NO_X, PM_{10}, and CO on an hourly basis than firing natural gas. For operating Scenarios 1 and 2, the total annual emissions when firing ULSD would be less than the total annual emissions when firing natural gas because natural gas operating hours would be higher. This is because ULSD would only be burned during curtailment.

The Air Emissions Risk Analysis (AERA) and Risk Assessment Screening Spreadsheet (RASS) tool was used to evaluate air toxics emissions for acute and chronic (non-cancer) hazard indices, and cancer risks associated with the project for Scenario 2. It was also used to assess a "Full Winter" scenario which represents burning ULSD constantly from December through February. This is nearly twice the maximum emissions allowed under the Air Permit as described in Scenario 4. This would constitute a violation of GRE's current Air Permit.

Air Emissions Risk Analysis

To determine potential impacts to human health from the addition of dual fuel burners to Unit 2 CT, an AERA was conducted for the project's air pollution sources following MPCA recommended practices. As described on the MPCA's website, "an AERA is a process that uses spreadsheets, computer models, and health benchmarks to estimate the potential human health risks from air pollution emitted by a facility. An AERA describes the potential risks posed to communities closest to the facility, which have the highest level of exposure to its emissions."[37] A cumulative AERA that analyzes offsite sources and ambient background concentrations along with the project's sources was not completed. This is because only the project's contribution to health risks from air pollution were assessed. Note that this area of Minnesota is in attainment of National and State ambient air quality standards in Minn. R. 7009.0080-.0090.

The EPA's American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) regulatory air dispersion model was used to estimate air toxic concentrations with project-specific parameters. More information describing this model is provided in Appendix B. Comparison of modeled outputs from AERMOD to Minnesota Ambient Air Quality Standards (MAAQS) and National Ambient Air Quality Standards (NAAQS) or Significant Impact Levels (SILs) was not performed as justified and described further in Appendix B.[38] Rather, GRE's project-specific data (Unit 2 CT stack height, flow rate, exhaust temperature and site appropriate meteorology) were entered into AERMOD to develop 1-hour, 24-hour, monthly, and annual "unit dispersion values" that were used to complete the MPCA's RASS.

The RASS is a spreadsheet-based tool that can estimate air concentrations from the unit dispersion values (developed from AERMOD) and project emission rates (taken from the Air Permit in Appendix B), and then compare the calculated air concentrations to health benchmarks. The RASS allows for estimations of cancer risk and hazards (non-cancer) for a variety of hypothetical exposure scenarios for several potential exposure durations. An acute exposure duration refers to a short exposure of one day or less. Chronic refers to an exposure of approximately 8 years or more. Subchronic is an intermediate exposure period of more than 30 days to 8 years.

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[37] Minnesota Pollution Control Agency (n.d.) *Air emissions risk analysis (AERA)*, retrieved from: https://www.pca.state.mn.us/business-with-us/air-emissions-risk-analysis-aera.

[38] Appendix B states that a full SIL analysis in addition to an AERA is not warranted since the maximum modeled hourly emissions (0.416 ug/m3) do not raise concern for health impacts.

Air concentrations are multiplied by scalars in the RASS to estimate the added risk from air pollutant deposition and build up in the food chain. The RASS presents various scenarios which cumulatively are inclusive of inhalation, consumption of home-bred animals, homegrown crops, and homegrown eggs, as well as incidental soil ingestion. The values in **Table 9** are compared to a risk guideline of 1, where estimated risks or hazards above 1 would require a reduction in the project to maintain a risk factor below 1. The modeled emissions from the project are not above the risk guideline value of 1. This is also true for the project when based on the 240 tpy maximum permitted NOx emissions allowed to GRE if they were to switch to alternate operating scenario.

GRE ran the RASS based on their current operations which cap emissions at 225 tpy of NO_x. This included modeling maximum ground-level concentrations while examining meteorological data during the winter months from December 1st to February 28th. EERA staff contracted HDR to run the RASS as a third party (**Appendix H**) based on the potential operating scenario allowed in GRE's Air Permit of a 240 tpy NO_x, but otherwise under the same parameters. Organic liquid working and breathing losses from the new 500,000-gallon ULSD AST during the entire year were incorporated by GRE and HDR.

As seen in **Table 9**, the result of the RASS for both scenarios is well below the acute, subchronic, and chronic health risk guideline values of 1. If the project were to emit at its permitted maximum allowable Air Permit limit under the alternate operating scenario of 240 tpy of NO_x the results still demonstrate that the project would not be expected to contribute significantly to human health impacts in the area.

As two short term or acute examples, NO_X and SO_2 emissions (lb/hr) increase when firing ULSD as compared to natural gas, as shown in **Table 8**. The RASS establishes acute air toxic values of 470 $\mu g/m^3$ and 660 $\mu g/m^3$ for these pollutants, respectively. The modeled NO_X and SO_2 maximum ground-level concentrations are 18 $\mu g/m^3$ and 0.17 $\mu g/m^3$, respectively, which are well below the air toxic values. For a short-term and annual example calculation, see Appendix B.

Table 9 Risk Assessment Spreadsheet Post-Project Summary

Risk Type	GRE 225 tpy Post-project Results	Third party 240 tpy Post-project Results	Risk Guideline Value
Acute	0.055	0.055	1
Subchronic non-cancer	0.003	0.003	1
Chronic non-cancer	0.002	0.002	1
Cancer Index	0.006	0.006	1
Multi-Pathway chronic non-cancer (resident)	0.002	0.002	1
Multi-Pathway cancer (resident)	0.007	0.007	1
Multi-Pathway chronic non-cancer (farmer)	0.002	0.002	1
Multi-Pathway cancer (farmer)	0.177	0.182	1
Multi-Pathway chronic non-cancer (gardener)	0.002	0.002	1
Multi-Pathway chronic cancer (gardener)	0.010	0.010	1
Indirect Pathway Cancer Index (resident)	0.001	0.001	1
Indirect Pathway Cancer Index (farmer)	0.171	0.182	1
Indirect Pathway Cancer Index (gardener)	0.004	0.005	1

The closest sensitive receptors to Unit 2 CT where air pollutants could settle include a park (one mile away), childcare center (one and one-half miles away), school (two miles away), and nursing home (two miles away). See Map 9 for deposition characteristics of the project's modeled air dispersion. The worst impacts would be expected during the winter, when Unit 2 CT is most likely to operate on ULSD for comparatively lengthier periods of time than during other parts of the year. The nearest sensitive receptor, the park, is likely to have less visitors during the winter. The results of the RASS on health impacts in conjunction with low deposition values at these sensitive receptors under conservative scenarios as seen in Map 9 supports the conclusion that significant health impacts from the project's air quality is not expected.

b. Vehicle emissions - Describe the effect of the project's traffic generation on air emissions. Discuss the project's vehicle-related emissions effect on air quality. Identify measures (e.g. traffic operational improvements, diesel idling minimization plan) that will be taken to minimize or mitigate vehicle-related emissions.

During construction, heavy truck traffic will increase. Traffic will be infrequent and occur for short periods as equipment and tank parts are delivered. There will also be an increase in personal vehicle traffic for an estimated 20 to 40 construction workers.

Over the life of the project, there will be infrequent truck traffic associated with refilling the new ULSD AST. Approximately 65 tanker trucks would be required to initially fill the new AST. After the initial filling, refilling the tank is usually accomplished over a few weeks each fall or spring, but could occur over a 48- to 72-hour period if needed during an extreme weather event. Consequently, air quality impacts from fuel deliveries would be short term in both Scenarios 1 and 2. This additional traffic is minimal compared to existing traffic on Highway 65 and is consistent with current facility traffic to fill the existing AST.

c. Dust and odors - Describe sources, characteristics, duration, quantities, and intensity of dust and odors generated during project construction and operation. (Fugitive dust may be discussed under item 17a). Discuss the effect of dust and odors in the vicinity of the project including nearby sensitive receptors and quality of life. Identify measures that will be taken to minimize or mitigate the effects of dust and odors.

Burner replacement will occur within Unit 2 CT and will not generate any dust. There will be a minimal amount of dust generated during construction of the ULSD and demineralized water ASTs. The roads on-site are paved, which will minimize dust generation. Excavation activities are not expected to generate soils that will require transport off-site. The facility parking lot is gravel. Daily traffic might generate minimal amounts of dust as workers enter and exit the lot. As necessary, BMPs will be used to minimize dust generated during construction.

ULSD combustion will occur at approximately 1,100°F, which effectively incinerates odor. The fixed roof design with breather vent will sufficiently mitigate potential odors from the ULSD AST.

18. Greenhouse Gas Emissions/Carbon Footprint

a. GHG Quantification: For all proposed projects, provide quantification and discussion of project GHG emissions. Include additional rows in the tables as necessary to provide project-specific emission sources. Describe the methods used to quantify emissions. If calculation methods are not readily

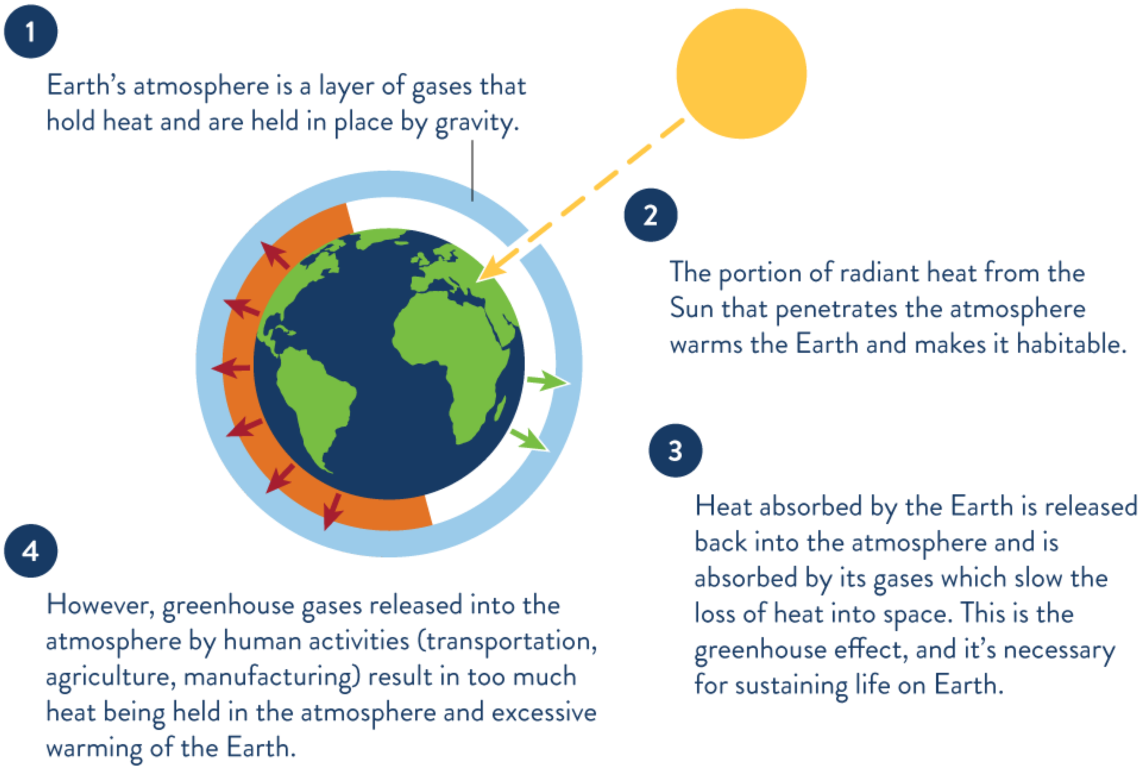
available to quantify GHG emissions for a source, describe the process used to come to that conclusion and any GHG emission sources not included in the total calculation.

Project GHG emissions include construction-related emissions and operation-related emissions from Unit 2 CT when firing ULSD.

Construction Emissions

The temporary GHG emissions during construction are limited to construction equipment and mobile sources for labor and parts delivery. Primary construction activities include site grading and preparation, tank and pipe installation, pump house building extension, and Siemens skids installation. Each AST will take approximately one month to install.

Figure 5 Greenhouse Gasses



Construction equipment will likely include two cranes, grading equipment (for example, skid steer loaders), trenchers, and miscellaneous other equipment (for example, welding). A list of assumptions used to calculate construction GHG emissions is included as Appendix C. Construction GHG emissions totaling 180 tons of CO_2e over the 30-year life of the project were estimated using the EPA *Simplified GHG Emissions Calculator* spreadsheet tool. Prorated over the project lifetime of 30 years, the construction related GHG emissions are six tons of CO_2e per year.

Operation Emissions

Operation GHG emissions calculations assume Unit 2 CT operates up to 75 hours per year on ULSD, even though it might not operate on ULSD in any given year, as described in GRE's expected maximum runtime in Scenario 2. GRE calculated operational emissions for GHG with maximum hourly emissions from Unit 2 CT (**Table 8** and repeated for clarity in **Table 10** below) for ULSD for CO_2, CH_4, and N_2O by multiplying the value by 75 hours and the pollutant's corresponding Global Warming Potential (GWP)[39] to convert values to CO_2e. This value is then divided by 2,000 to convert to short tons.

Table 10 summarizes greenhouse gas emission for the project from a full year of operation based on the estimated maximum fuel usage from Scenario 2 (natural gas and ULSD).[40] This results in 12,829 short tons per year of CO_2e. For comparison, 12,829 short tons of CO_2e is the equivalent of adding 58 semi-trailer trucks driving 120,000 miles over the course of a year to the road.[41] On a per person, annual basis the project has the equivalent carbon footprint as 802 average Americans according to the Nature Conservancy, which points out "the average carbon footprint for a person in the United States is 16 tons."[42]

Table 10 Unit 2 CT Greenhouse Gas Emissions

GHG Pollutant	Maximum Hourly Emissions (lb/hr)		Global Warming Potential	Scenario 2 (75-hour runtime)
	Natural Gas	ULSD		ULSD CO_2e Annual Emissions (Short Tons)
CO_2	235,007	340,945	1	12,785
CH_4	4.43	13.8	25	12.94
N_2O	0.44	2.77	298	30.95
CO_2e	235,250	342,115	N/A	12,829

Relative Change in Emissions

Figure 6 shows reported facility emissions from 2010 to 2021.[43] Emissions from the facility have fluctuated widely since 2010 from a low of 14,966 short tons in 2020 to a high of 67,382 short tons the following year. On average, the facility emitted 36,064 short tons of CO_2e per year between 2010 and 2021. Much like facility emissions, project emissions will vary. Actual emissions are expected to be influenced by future natural gas curtailments, which would necessitate Unit 2 CT to burn ULSD. Natural gas curtailments are expected to be influenced by the severity of future extreme cold weather events. GRE believes Unit 2 CT will likely operate on a mixture of natural gas and ULSD most like Scenario 1.

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[39] U.S. Environmental Protection Agency (n.d.) *Global Warming Potentials Used For Reporting*, retrieved from: https://ccdsupport.com/confluence/display/help/Table+A-1+of+Subpart+A+of+Part+98+-+Global+Warming+Potentials. (This tool reports in metric tons. Staff rounded to a whole number then multiplied by 1.10231131 to reach short tons. Short tons number was again rounded to a whole number.)

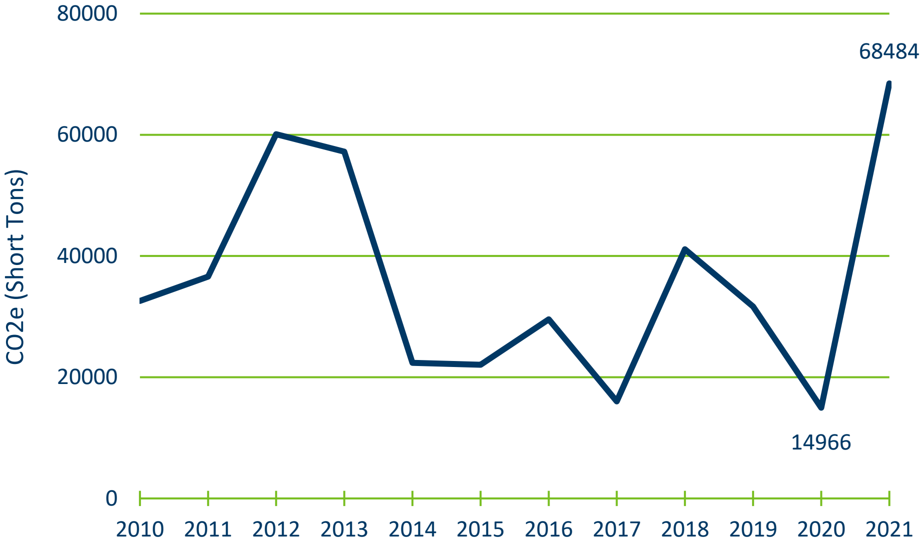
[40] Comparative GHG emissions in terms of maximum hourly impacts is represented in Table 8. (See Scenarios 1 to 4 data and discussion in Item 17.)

[41] Sharky, Grace: Freight Waves (April 9, 2021) *What is the carbon footprint of a truck?*, retrieved from: What is the carbon footprint of a truck?, retrieved from: https://www.freightwaves.com/news/what-is-the-carbon-footprint-of-a-truck (12,829 short tons converted to metric tons divided by 223 equals 57.5).

[42] The Nature Conservancy (n.d.) *How to Help: Calculate Your Carbon Footprint*, retrieved from: https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/#:~:text=The%20average%20carbon%20footprint%20for,under%202%20tons%20by%202050.

[43] U.S. Environmental Protection Agency (n.d.) *Facility Level Information on Greenhouse Gasses Tool*, retrieved from https://ghgdata.epa.gov/.

Figure 6 Facility Reported GHG Emissions



Reporting the percent change in emissions is difficult. Frankly, staff does not know how often Unit 2 CT will burn ULSD. As stated above, burning ULSD is dependent on natural gas supply or prices, which is likely dependent on future weather patterns. Therefore, this EAW shows a range of estimates showing the percent change in emissions.

Table 11 shows the estimated percent increase in emissions caused by the project when compared to total facility emissions from 2010 to 2021. The low year, high year, and average were used.

Table 11 Facility Percent Emissions Increase (Annual)

Unit 2 CT ULSD Usage (hours per year)	Percent Increase in Annual Facility GHG Emissions[1]		
	Average	Low Year	High Year
24[2]	11.38%	27.43%	6.61%
75[3]	35.57%	85.72%	20.65%

[1] Based on reported GHG emissions from 2020 to 2021. See Figure 6.

[2] From Scenario 1.

[3] From Scenario 2.

In the recent past, polar vortex events in the northern hemisphere typically occur about once every other year.[44] Therefore, for lifetime impacts, staff assumed a natural gas curtailment would occur every two years. Five years is also included should these events not occur as often as predicted. These increases are shown in **Table 12**. The percent increase over the life of the project should a natural gas curtailment happen each year is identical to the yearly percent increase shown above.

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[44] *Supra* note 11.

Table 12 Facility Percent Emission Increase (Lifetime)

Unit 2 CT ULSD Usage (hours)	Percent Increase in Lifetime Facility GHG Emissions[1]		
	Average	Low Year	High Year
24[2] every two years	5.69%	13.71%	3.30%
75[3] every two years	17.79%	42.86%	10.32%
24[2] every five years	2.28%	5.49%	1.32%
75[2] every five years	7.11%	17.14%	4.13%

[1] Based on reported GHG emissions from 2020 to 2021. See Figure 6.

[2] Scenario 1.

[3] Scenario 2.

Staff also estimated the percent change in emissions based on Scenarios 1 and 2. Staff believes that Scenario 1 provides the most reasonable look forward. Scenario 2 was compared to other resource elements as the worse-case scenario—it is appropriate to do the same for greenhouse gas emissions. These scenarios include both natural gas and ULSD usage. **Table 13** shows what percentage of yearly emissions would come from ULSD. **Table 14** shows lifetime emissions as was calculated above.

Table 13 Unit 2 CT Percent Emission Increase (Annual)

ULSD Usage (hours per year)	Percent Increase in Annual Unit 2 CT GHG Emissions	
	Natural Gas Usage (hours per year)	
	600[1]	1200[2]
24[1]	5.82%	2.91%
75[2]	18.19%	9.10%

[1] Scenario 1.

[2] Scenario 2.

Currently, there are no Minnesota-specific thresholds of significance for determining impacts of GHG emissions from an individual project on global climate change. In the absence of such a threshold, Minnesota Rule 4410.4300, Subpart 15, Part B, establishes a mandatory category requiring preparation of an EAW for stationary source facilities generating 100,000 tons of GHGs per year. The purpose of an EAW is to assess whether a proposed project has the potential to result in significant environmental effects, which aids in determining whether an EIS is needed. Regarding GHG emissions, state regulations establish 100,000 tons per year as the threshold to prepare an EAW to aid in determining if potential significant environmental effects might exist. A reasonable conclusion is that a project with GHG emissions below 100,000 tons per year does not have the potential to result in significant GHG effects. Under Scenario 2, the project is estimated to emit 12,829 short tons of CO_2e annually (**Table 8**).

Table 14 Unit 2 CT Percent Emissions Increase (Lifetime)

ULSD Usage (hours)	Percent Increase in Lifetime Unit 2 CT GHG Emissions	
	Natural Gas Usage (hours per year)	
	Scenario 1	Scenario 2
24[2] every two years	2.91%	1.46%
75[3] every two years	9.10%	4.55%
24[2] every five years	1.16%	0.58%
75[2] every five years	3.64%	1.82%

[1] Scenario 1.

[2] Scenario 2.

b. GHG Assessment

i. Describe any mitigation considered to reduce the project's GHG emissions.

GRE indicated that an annual restriction of hourly operation on ULSD was considered but deemed too risky as a mitigation measure. GRE explained that Unit 2 CT is offered into the MISO market and is called on by MISO as the electrical grid needs the resource for reliability purposes. Restricting the operation of Unit 2 CT at the regulatory level could create situations where MISO needs the generation capability and characteristics, but Unit 2 CT would be unavailable due to restrictions. Because of this, GRE does not propose any specific conditions or limitations on the project.

GRE noted a comparably sized energy storage system was also considered as an alternative and was deemed too costly.

ii. Describe and quantify reductions from selected mitigation, if proposed to reduce the project's GHG emissions. Explain why the selected mitigation was preferred.

GRE does not propose any specific mitigation measures for the project.

iii. Quantify the proposed projects predicted net lifetime GHG emissions (total tons/#of years) and how those predicted emissions may affect achievement of the Minnesota Next Generation Energy Act goals and/or other more stringent state or local GHG reduction goals.

Lifetime GHG emissions for the project are expected to be 385,050 tons of CO_2e should Unit 2 CT burn USLD for 75 hours per year—GRE's upper operating estimate. This estimate is based on the quantifications from Section 18. a. (12,829 short tons) multiplied by the life of the project (30 years) plus 180 tons in construction emissions, which totals 385,050 tons.

Directly, the project does not contribute to achieving the goals of the Minnesota Next Generation Energy Act. The project increases CO_2e emissions at the facility. Indirectly, GRE points out that the project is driven by GRE's portfolio evolution to decarbonize and increase renewable energy while also maintaining resiliency and reliability. To the extent that the project enables decarbonization of GRE's larger generation portfolio, the project may contribute to achieving Minnesota's energy goals.

19. Noise

Describe sources, characteristics, duration, quantities, and intensity of noise generated during project construction and operation. Discuss the effect of noise in the vicinity of the project including 1) existing noise levels/sources in the area, 2) nearby sensitive receptors, 3) conformance to state noise standards, and 4) quality of life. Identify measures that will be taken to minimize or mitigate the effects of noise.

The facility is directly east of State Highway 65, which produces regular background traffic noise on the order of 49-52 dBA at the fence line based on a 2005 noise monitoring study conducted for the Unit 2 CT environmental assessment.

According to data from Siemens, the turbine manufacturer, the project is not anticipated to increase sound levels at nearby receptors (Appendix F). There will be a permanent increase in intermittent truck traffic due to ULSD deliveries. This noise is not expected to be significant in conjunction with current facility operations, including truck deliveries for the existing 150,000-gallon AST for Unit 1 CT.

Noise impacts would occur, however, during construction. Crews would be present during daytime hours. Major noise producing activities are associated with clearing and grading, material delivery, and other diesel engine-driven construction equipment.

Noise from heavy equipment and increased vehicle traffic will be intermittent and occur during daytime hours. Noise associated with heavy equipment can range between 80 and 90 dBA at full power when 50 feet from the source.[45] Heavy equipment generally runs at full power up to 50 percent of the time.[46] Point source sounds decrease six dBA at each doubling of distance;[47] therefore, a 90 dBA sound at 50 feet is perceived as a 72 dBA sound at 400 feet and a 60 dBA sound at 1,600 feet.

The closest residence is approximately 1,000 feet from the project. With the project construction capable of producing 90 dBA, sound would measure between 66 and 60 dBA at the receptor, given that 66 dBA is capable at 800 feet and 60 dBA is capable at 1,600 feet. This estimation is conservative as it does not account for terrain or vegetation absorbing sound between the source and receptor. Given that

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[45] Federal Highway Administration (August 24, 2017) *Noise: Construction Noise Handbook*, retrieved from: https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm.

[46] *Ibid*.

[47] Minnesota Pollution Control Agency (November 2015) *A Guide to Noise Control in Minnesota*, retrieved from: https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf, at 10.

construction equipment generally runs at full power 50 percent of the time, the project is expected to be within state noise standards.

An exceedance of noise standards need not occur for a negative impact to occur. For example, “interference with human speech begins at about 60 dBA.”[48] A 70 dBA sound interferes with telephone conversations, and an 80 dBA sound interferes with normal conversation. Potential noise impacts would be mitigated by proper muffling equipment fitted to construction vehicles and restricting activities during nighttime hours.

Table 15 Noise Levels from Common Sources

Sound Pressure Level (dBA)	Typical Sources
140	Jet Engine at 25 meters (~80 feet)
130	Jet Engine at 100 meters (~400 feet)
120	Rock concert
110	Pneumatic chipper
100	Jackhammer at 1 meter (~3 feet)
90	Chain saw at 1 meter (~3 feet)
80	Heavy truck traffic
70	Business office, vacuum cleaner
60	Conversational speech
50	Library
40	Bedroom
30	Secluded woods
20	Whisper

Source: MPCA

20. Transportation

a. Describe traffic-related aspects of project construction and operation. Include: 1) existing and proposed additional parking spaces, 2) estimated total average daily traffic generated, 3) estimated maximum peak hour traffic generated and time of occurrence, 4) indicate source of trip generation rates used in the estimates, and 5) availability of transit and/or other alternative transportation modes.

1) Existing and proposed additional parking

The facility has sufficient parking to accommodate existing staff and construction workers required for the project. The project would not add any parking spaces during or after construction.

2) Estimated total average daily traffic generated

There are currently six to eight GRE staff working at the facility. During construction, there will be an additional two to four GRE staff each day, plus about 20 to 40 contractors. In addition, there will be infrequent truck deliveries for the tank pieces, Unit 2 CT burners, pipes, pumps, and associated supplies.

3) Estimated maximum peak hour traffic generated and time of occurrence.

It is expected that the GRE staff (about eight to 12) and contractors (about 20 to 40) will arrive at approximately 7:30 a.m. and will depart around 4:30 p.m. Monday through Friday or at shift changes. This equates to approximately 60 arrivals and 60 departures over a workday during the peak of construction. Infrequent equipment deliveries by truck will occur throughout the workday.

4) Source of trip generation rates used in estimates.

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[48] U.S. Bureau of Reclamation (June 2008) *Navajo Reservoir RMP/FEA, Appendix E Noise*, retrieved from: https://www.usbr.gov/uc/envdocs/ea/navajo/appdx-E.pdf.

The source for trip estimates is based on GRE staff knowledge of facility staff and staff expected to support the project. Construction staff were estimated by GRE's project manager, based on past plant projects of this scale.

5) Public Transit

No public transportation or alternative modes of transportation are available to the facility.

Traffic

Traffic near the facility would temporarily increase during construction. No road closures or detours would be required. Trips generated during construction would occur at the beginning and end of the day and at the time of a shift change. No additional plant staff would be needed to operate the facility after construction is complete.

The project would require a new 500,000-gallon ULSD AST. Filling this tank initially will require approximately 65 truck deliveries, which would likely occur over several days, during normal working hours. It takes 20 to 30 minutes to unload one ULSD delivery truck. Each truck contains approximately 7,500 gallons. During periods of natural gas curtailment when firing ULSD, fuel delivery trucks would be required to refill the AST. Unit 2 CT would be able to run for about 25 hours before refilling its ULSD AST is necessary. If a natural gas curtailment is expected to last longer than 25 hours, as estimated in Scenario 2, approximately two to three trucks per hour would then be needed to refill.

The facility is accessible via a frontage road of State Highway 65. Once exiting the highway, no residential or commercial properties are passed when delivering fuel to site. Map 8 shows a representation of the expected haul route. Truck deliveries will not exceed seasonal weight restrictions per Minnesota Statute 169.8. Because all roads are paved to the site, dust control measures would not be needed. The facility has an existing 150,000 AST for Unit 1 CT, which is periodically filled by truck. Although there will be an increase in truck traffic associated with the project, this incremental increase is consistent with current operations.

b. Discuss the effect on traffic congestion on affected roads and describe any traffic improvements necessary. The analysis must discuss the project's impact on the regional transportation system. If the peak hour traffic generated exceeds 250 vehicles or the total daily trips exceeds 2,500, a traffic impact study must be prepared as part of the EAW. Use the format and procedures described in the Minnesota Department of Transportation's Access Management Manual, Chapter 5 (available at: http://www.dot.state.mn.us/accessmanagement/resources.html) or a similar local guidance.

The most current data on MnDOT's website shows that State Highway 65 has an average daily traffic load of 1,200 high-capacity vehicles. GRE estimates an increase of two to three ULSD high-capacity vehicles (delivery trucks) per hour during natural gas curtailments. Annual average daily traffic counts for State Highway 65 are relatively unchanged from 2005. Traffic counts in 2004 were 11,600; in 2006 were 12,700; and in 2018 were 12,400. The project is not expected to cause traffic congestion. Impacts are expected to be incremental and negligible. Total facility and project traffic estimates are below thresholds listed. As a result, no traffic impact study is required.

c. Identify measures that will be taken to minimize or mitigate project related transportation effects.

In the event of a natural gas curtailment requiring ULSD operations, there will be an increase in fuel truck delivery traffic to maintain the supply of ULSD to the ASTs. As noted, there would be an additional two to three trucks per hour maximum. The loading capacity is the same for Unit 1 CT, meaning there could be as many as four to six trucks per hour needed to maintain ULSD supply if both units are operating for an extended period. GRE states that plant staff would queue trucks inside the facility as feasible for both efficiency and to minimize potential traffic disruptions on rural roads to the west and north.

No additional mitigation is proposed.

21. Cumulative Potential Effects

a. Describe the geographic scales and timeframes of the project related environmental effects that could combine with other environmental effects resulting in cumulative potential effects.

Minnesota Rule 4410.0200 defines “cumulative potential effects” as impacts to the environment that result from “the incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects actually planned or for which a basis of expectation has been laid, regardless of what person undertakes the other projects or what jurisdictions have authority over the projects.”

The “environmentally relevant area” includes locations where the potential effects of the project coincide with the potential effects of other projects to impact the elements studied in this EAW. For this project, staff considered the facility boundary as environmentally relevant area.

b. Describe any reasonably foreseeable future projects (for which a basis of expectation has been laid) that may interact with environmental effects of the proposed project within the geographic scales and timeframes identified above.

The applicant is working with Form Energy to construct an energy storage project within the facility fence line (Figure 7). Construction is anticipated to begin in 2024. The energy storage project would be operational no earlier than fourth quarter 2024. The technology uses air to oxidize iron housed within clustered modules to charge a cell for later electricity release. In total, there will be enough modules to provide 1.5 MW of electricity for 100 hours.

GRE disclosed that the energy storage project is still under design. GRE does know, however, that it would neither be directly interconnected nor directly charged from either Unit 1 CT or Unit 2 CT. Instead, it will be connected to the contiguous substation and charged from the electrical grid. Unit 1 CT and Unit 2 CT will not, in any way, be changed, modified, or operated differently because of the energy storage project.

GRE does expect that some periodic maintenance will be required, and that waste will be generated from the clustered modules. These wastes will be handled, stored, and hauled off-site, like other facility waste materials. GRE is unaware if these wastes would constitute hazardous waste but indicates plant staff will handle them appropriately if applicable. Form Energy has not provided GRE with specific details or quantities of any expected maintenance or waste generation.

c. Discuss the nature of the cumulative potential effects and summarize any other available information relevant to determining whether there is potential for significant environmental effects due to these cumulative effects.

It is assumed that the construction-related impacts of the energy storage project will be short-term, for example, one year or less.

Figure 7 Energy Storage Project Visualization

Human Settlement

Construction impacts might cause intermittent and temporary local disturbances, such as increased noise levels, visual disturbances, and increased air emissions from passing traffic. Long-term cumulative effects include visual impacts. The energy storage project is expected to have higher visual impacts as it will be closer to the road. This might erode rural character in the area; however, the facility has been a fixture on the landscape for 50 years. Economic impacts are expected to be positive from local expenditures for fuel and other related effects. Positive impacts to energy reliability are also expected.

Natural Environment

Cumulative potential effects are anticipated to be minimal to moderate. The energy storage project is in an industrial area. While a planted prairie will be impacted, it provided only marginal overall wildlife habitat.

The energy storage project is expected to increase the amount of impervious surface at the facility, thus increasing stormwater runoff. Stormwater would be diverted to the existing basin, which is expected to effectively handle the increased volume for most rain events. The increased impervious surface would further contribute to the total amount of water the system needs to handle, however, making it more difficult for the retention basin to cope with a 100- or 500-year flood event. Since the basin is not designed to handle a 100-year storm event, it is vulnerable to increased storm event risks associated with climate change, exacerbated by the project and the energy storage project’s cumulative increased impervious surface. Due to the low probability of the 100-year or 500-year flood event occurring, stormwater impacts associated with the project and the energy storage project are expected to be minimal, even with the uncertainties of climate change.

As discussed in Item 7, the most concerning risk would occur if two extremely low probability events happened simultaneously, such as a 100-year storm event and a breach in the new ULSD AST. While this risk is minimal, expanding the capacity of the retention basin could help to alleviate the risk.

22. Other Potential Environmental Effects

If the project may cause any additional environmental effects not addressed by items 1 to 19, describe the effects here, discuss the how the environment will be affected, and identify measures that will be taken to minimize and mitigate these effects.

Environmental Justice

Environmental Justice (EJ) refers to the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. In general, EJ is intended to ensure all people benefit from equal levels of environmental protection and have the same opportunities to participate in decisions that may affect their environment or health.

EJScreen, an interactive screening and mapping tool developed by the EPA, provides a nationally consistent dataset and approach for combining EJ environmental and demographic indicators.[49] EJSCREEN shows that within the census tract where the project resides, all environmental indicators such as air, waste, or water are better than the state averages. There is one Hazardous Waste Treatment, Storage, and Disposal Facility but no Superfund Sites. This is also the case for Isanti County as a whole. The full EJSCREEN Report can be found in Appendix D.

MPCA maintains an online mapping tool entitled *Understanding Environmental Justice in Minnesota*, which “allows users to identify census tracts where additional consideration or effort is warranted to ensure meaningful community engagement and to evaluate the potential for disproportionate adverse impacts….” The MPCA “considers a census tract to be an area of concern for environmental justice if at least 40% of people reported income less than 185% of the federal poverty level.” Two census tracts near the project are identified by the MPCA as areas of concern: Tract 130302 and Tract 130304.

The MNRISKS model, developed by MPCA, compares air pollution levels against health benchmarks to estimate the potential for negative health effects. A health benchmark is an amount of air pollution that is unlikely to result in health effects after a specific exposure period. Higher scores mean higher risks, but don't necessarily mean that health effects are occurring in an area.

According to MNRISKS, cancer and non-cancer health risks from air pollutants released by permitted and non-permitted sources near the project area (Census Tract 130302) are in the lowest 30 percent of Minnesota air scores, indicating that air quality that can impact health near the facility is better than 70 percent of the state.[50] The MNRISKS model indicates that the largest contributing emissions sources in Census Tract 130302 are wood burning for home heating (33 percent); traffic emissions (25 percent); and agricultural and yard waste burning (12 percent).

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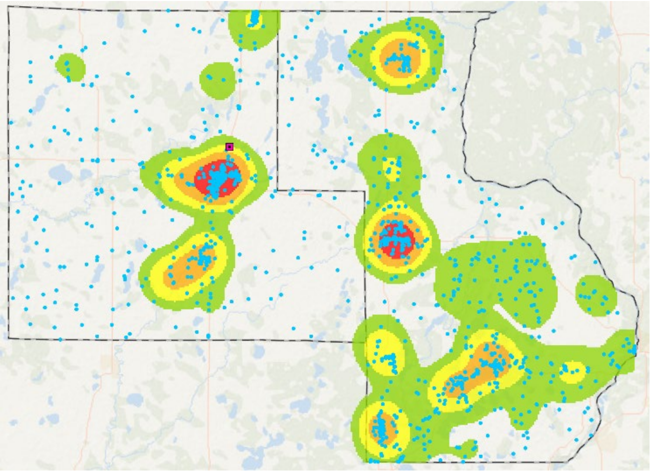
[49] U.S. Environmental Protection Agency (n.d.) *EJScreen*, retrieved from: https://www.epa.gov/ejscreen.

[50] *Supra* note 34.

The air pollution score for Cambridge is 0-1, the tool's lowest score representing the spectrum of outdoor air quality that can impact health in Minnesota. This is based on Minnesota's air emission inventory or the gathering of annual air emission data from regulated entities. An area's score indicates the highest annual risk value and can be used to identify potential inequalities in air pollution exposure. For comparison, other areas of Minnesota with higher values such as Minneapolis, has scores up to a magnitude of 20 times higher while remaining in compliance with air regulations. The area near Cambridge is in attainment of National and State ambient air quality standards in Minnesota Rule 7009.0080-0900.

Figure 8 What's In My Neighborhood?



MPCA maintains the *What's in My Neighborhood* database that shows potentially contaminated sites and an inventory of businesses that have applied for environmental permits and registrations from the agency. Just because a site is listed in the database does not necessarily imply a threat to the environment (**Map 10**). There are no nearby sites that are expected to interfere with the project as most are over a mile away and do not share the same potential for environmental effects.

Figure 8 shows these sites in relation to the project, which is represented by a pink square. An overlay is applied that shows the density of potentially contaminated sites and environmental permits in the surrounding area by showing the concentration of occurrences when compared to Isanti and Chisago counties. Red is greater than orange, which is greater than yellow, which is greater than light green. The area of lowest concentration is transparent and does not show on the map. Blue points are individual sites. While there is elevated density near the project, much of it can be attributed to Cambridge.

Staff conducted a demographic assessment of the affected community to identify low-income and minority populations that might be present. U.S. Census data was used. Low-income and minority populations are determined to be present in an area when the low-income percentage or minority group percentage exceeds 50 percent or is "meaningfully greater" than in the general population of the larger ROC. In this analysis, a difference of 10 percentage points or more was used as the threshold to distinguish whether a "meaningfully greater" low-income or minority population resides in the ROC.

This analysis includes the census tracts intersected by the facility and those that modeled the highest one-hour air concentrations from the project. Note, however, that these highest concentrations comply with air regulations and do not demonstrate health risks based on the outcomes of the AERA as described in the Air Quality section of this EAW. The highest one-hour concentration tier (0.401-0.416 ug/m^3) was chosen for comparative purposes because none of the modeled values consist of a reasonable air quality risk, thus these concentrations alone are most representative to use in analyzing the project's magnitude of potential impacts to air quality in environmental justice communities. These census tracts are the best approximation of the geographic area within which potential disproportionate adverse impacts from the project could occur. Isanti and Chisago counties, which contain these census tracts, are considered representative of the general population against which census tract data can be compared. These counties serve as the region of comparison (ROC) for this assessment.

Table 16 lists the percentage of individuals living below the poverty level and household income. It also lists the percentage of those persons who did not self-identify as non-Hispanic white alone. Information about Minnesota and Isanti and Chisago counties is provided for context.

Table 16 Environmental Justice

Area	Census Tract	% Below Poverty	Median Household Income ($)	% Minority**
Minnesota	—	9.29	73,382	21.03
Isanti County	—	7.42	76,999	6.49
Isanti County	130200	15.82	56,090	9.62
Isanti County	130302	9.19	51,318	5.83

Source: U.S. Census Bureau, 2016-2020 American Community Survey
* The ROC is calculated by dividing the total population living below poverty or the total minority population in the ROC by the total population of Isanti and Chisago Counties.
** Percent non-Hispanic white alone.

The low-income and minority populations in the ROI census tracts, represented by the percentage living in poverty and those not self-identifying as white alone, were compared with the ROC to determine if any were greater than 50 percent or ≥10 percentage points than the ROC. None of the percentages for the census tracts exceed 50 percent or the ROC percentage by ≥10 percentage points. This shows that a meaningfully greater low-income or minority population does not reside in the project area based on the defined threshold for environmental justice impacts. Thus, disproportionate and adverse impacts to these populations are not expected. In addition, the higher one-hour concentrations that could deposit on these census tracts as modeled for the project are not significantly commensurate to higher air quality or human health impacts. Mitigation is not proposed.

RGU CERTIFICATION

Acting as an agent on behalf of the Minnesota Public Utilities Commission, I hereby certify that:

- The information contained in this document is accurate and complete to the best of my knowledge.
- The EAW describes the complete project; there are no other projects, stages or components other than those described in this document, which are related to the project as connected actions or phased actions, as defined at Minnesota Rules, parts 4410.0200, subparts 9c and 60, respectively.
- Copies of this EAW are being sent to the entire EQB distribution list.

Andrew Levi
Environmental Review Manager
Department of Commerce

William Seuffert

Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission

Appendix A Maps

Appendix B Air Assessments

The project's potential air impacts were modeled with USEPA's regulatory model AERMOD to calculate site specific dispersion values to use as inputs to the Minnesota Pollution Control Agency's (MPCA) Risk Assessment Screening Spreadsheet (RASS). Although the RASS has an option to use default screening dispersion values based on distance to property line and stack height, these default dispersion values are not representative of the dispersion characteristics of the Unit 2 combustion turbine (Unit 2 CT). Thus, GRE chose to model with AERMOD to develop more representative values for pollutants from Unit 2 CT that can be used in the RASS instead of the default screening values.

A SIL analysis and output comparison to the MAAQS or NAAQS was not performed or required for a proper health impact analysis. First, modeling was only conducted to retrieve these values. Second, doing a full SIL analysis in addition to an AERA is not warranted since the maximum modeled concentrations are significantly less than the established hazard indices and thus do not raise concern for health impacts. The level of detail in environmental review and the effort spent performing additional analysis should be commensurate with the potential effects from the project and with the magnitude of the emissions and their likely health impacts on air quality.

A modeling analysis requires inputs of pollutant emission rates along with the parameters that characterize the release from each source (e.g. height, temperature, exit velocity), plus data on surrounding terrain, buildings, meteorology and receptor locations where exposure concentration calculations will be made. The air dispersion model provides estimations of air concentrations and deposition at each selected location. The modeling methodology provides a representative maximum potential health impact from air concentrations due to the project emissions to use to assess air quality impacts. AERMOD modeling setup and the RASS inputs and outputs are explained in each sub-section.

Air Dispersion Modeling – AERMOD

Air dispersion modeling used the USEPA regulatory model AERMOD (v22112) with the MPCA processed 2016-2020 St. Cloud Airport meteorological dataset. St. Cloud Airport was selected as the most representative weather station for the project's spatial setting when using Minnesota's Meteorological Site Selection Tool. In order to calculate the maximum annual average for the RASS, these five years of meteorological data were incorporated into AERMOD and the highest annual average was chosen. A receptor grid is a list of x,y coordinates where the model calculates an air concentration from the project emission sources. The receptor grid shown in Figure 9 of the main report follows current MPCA modeling best practices with the Cambridge Station fence line marking the starting point of compliance for modeled air concentrations where the public could potentially be impacted.

The project's two emissions sources were modeled: Unit 2 CT firing ULSD during the winter months of December, January, and February (2,160 hours per year), and organic liquid breathing and working losses from the ULSD aboveground storage tank (AST) for the entire year (8,760 hours). The EAW report is focused on the project impacts, therefore only the emissions associated with the project are evaluated. The Unit 2 CT and ULSD AST were modeled as point sources (i.e., stacks) using their respective design parameters. Table A-1 lists the stack parameters used in the modeling.

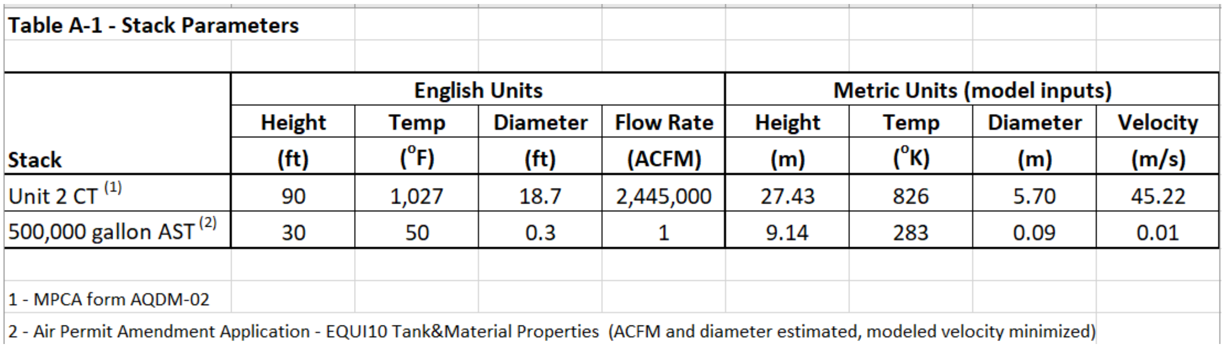


Table A-1 - Stack Parameters

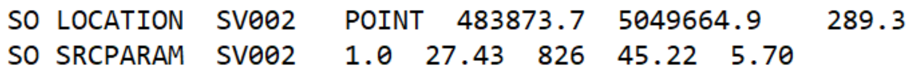
	English Units				Metric Units (model inputs)			
Stack	Height (ft)	Temp (°F)	Diameter (ft)	Flow Rate (ACFM)	Height (m)	Temp (°K)	Diameter (m)	Velocity (m/s)
Unit 2 CT (1)	90	1,027	18.7	2,445,000	27.43	826	5.70	45.22
500,000 gallon AST (2)	30	50	0.3	1	9.14	283	0.09	0.01

1 - MPCA form AQDM-02

2 - Air Permit Amendment Application - EQUI10 Tank&Material Properties (ACFM and diameter estimated, modeled velocity minimized)

Each source modeled emission rate was 1 gram per second to develop a unit impact (µg/m^3 per g/s) for the 1-hour and annual averaging periods needed in order to complete the RASS. A sample image of the AERMOD input file source parameters is shown below.

Screenshot of AERMOD Input for CT02



```
SO LOCATION  SV002   POINT  483873.7  5049664.9    289.3
SO SRCPARAM  SV002   1.0  27.43  826  45.22  5.70
```

Table 8 introduced in the Air Quality section of this EAW lists project hourly air emissions in pounds per hour as well as project annual air emissions for multiple operating scenarios (Scenarios 1 – 4) for both natural gas and ULSD fuel firing. Scenarios 1 and 2 were based on actual operating hours over the past 10 years for similar GRE combustion turbines across their fleet. Table A-2 shows that information. Scenario 1 represents a likely or 'typical' ULSD annual operating hours case (6-16 hours). Scenario 2 represents a realistic maximum annual operating hours assumption of 75 hours (2021 GRE maximum of 57.4 hours and 3-day Texas grid rolling blackouts). Scenarios 3 and 4 represent permit maximum allowable emissions on natural gas and ULSD not to be exceeded.

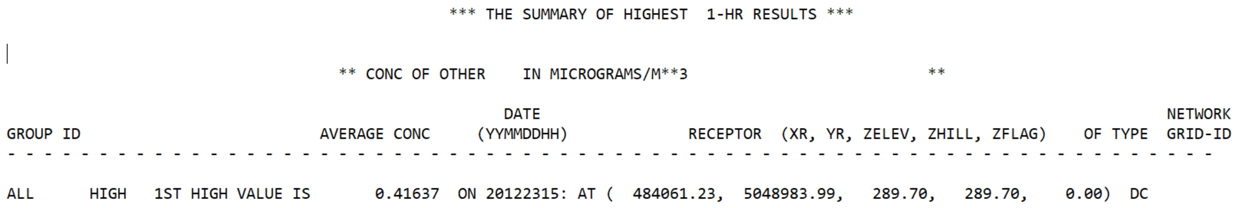
Table A-2 GRE Combustion Turbine Annual Operating Hours on ULSD Fuel

Station	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
Pleasant Valley Station 11	0	0	3.3	27.2	15	30.4	0	2	8.7	0	57.4	1.3	13
Pleasant Valley Station 12	0	0	2.4	37.7	7.1	6.6	14.2	12	19	0	23.3	6.5	12

Pleasant Valley Station 11	0	0	0	27.6	0.8	0	0	13.2	10	0.1	9.8	4.7	6
Elk River Peaking Station	6.4	6.7	14.8	42.3	19.5	1.3	8.4	2.8	22.5	1.6	50	0	16

As stated above, modeling of Unit 2 CT examines operations during the winter months of December, January, and February to determine the maximum hourly concentration. Because the projected actual firing of ULSD is on the order of a few hours to 3 days in the winter (during extremely cold temperatures when natural gas curtailment could occur), the maximum hourly concentration was an important potential air quality impact to consider. Modeling with 5 consecutive years of meteorological data during the winter months identified the location of the highest possible 1-hour concentration (0.416 µg/m^3) from Unit 2 CT burning ULSD fuel. This modeled value is based on a unit emission rate of 1 gram per second (g/s), which is then extrapolated to the various pollutants which are reviewed in the RASS by multiplying their respective emission rates on a g/s basis by the modeled concentration.
Map 9 shows the modeled maximum hourly concentration occurred approximately 0.5 mile southeast of the site, and similar magnitude hourly concentrations also occurred approximately 2 miles southeast of the site. A sample image of the AERMOD modeled output file is shown below.

Screenshot of AERMOD 1-Hour Results for CT02 at 1 g/s - Input to RASS



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                                                *** THE SUMMARY OF HIGHEST  1-HR RESULTS ***

|
                                    ** CONC OF OTHER    IN MICROGRAMS/M**3                          **

                                                      DATE                                                                    NETWORK
GROUP ID                          AVERAGE CONC     (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

ALL      HIGH   1ST HIGH VALUE IS       0.41637  ON 20122315: AT (  484061.23,  5048983.99,   289.70,   289.70,    0.00)  DC
```

Risk Assessment Screening Spreadsheet (RASS)

The MPCA developed a RASS tool that assesses the total exposure of a maximum exposed individual (MEI) from different pollutants for multiple exposure scenarios, pathways, and durations. A user inputs the project's highest modeled air concentration by receptor, pollutant, and averaging period, and the RASS calculates a potential health risk value. The RASS methodology for calculating the screening inhalation risks for each modeled pollutant is by dividing the maximum modeled air concentration by its Inhalation Health Benchmark for all averaging periods. The non-inhalation (ingestion) pathway risks and cancer risks for persistent bioaccumulative toxic chemicals is calculated via a multiplier applied to the pollutant-specific chronic (annual) inhalation risk. The model averaging-period for acute is 1-hour, subchronic is monthly, and chronic cancer and non-cancer is annual. The summation of all pollutants' risk values by exposure scenario, pathway, and duration in the RASS are compared to the air toxics guidance level of 1 to assess if the proposed project could result in potential health risks to humans within its impact area. The following calculation steps are provided for NO_2 and $PM_{2.5}$ as an example.

Example RASS Calculations Using AERMOD Results
User Inputs to RASS - AERMOD Results

1 g/s emission rate - Result is Unit Dispersion Value
Maximum 1 hour concentration = 0.416 µg/m^3
Maximum 3-month concentration = 0.00159 µg/m^3

User Inputs to RASS - Emission Rates (Table 11)

NO_X Hourly emission rate = 351 lb/hr x 0.126 g/s / lb/hr = 44.23 g/s
1-Hour NO_2 concentration = 44.23 g/s x 0.416 µg/m^3= 18.41 µg/m^3
Modeling assumed 100% conversion of NO_X to NO_2

$PM_{2.5}$ Annual emission rate = 14.9 tons/year x 0.0288 g/s / tons/year = 0.43 g/s
3-month $PM_{2.5}$ concentration = 0.43 x 0.00159 = 0.00068 µg/m^3
3-month concentration is conservative for annual exposure

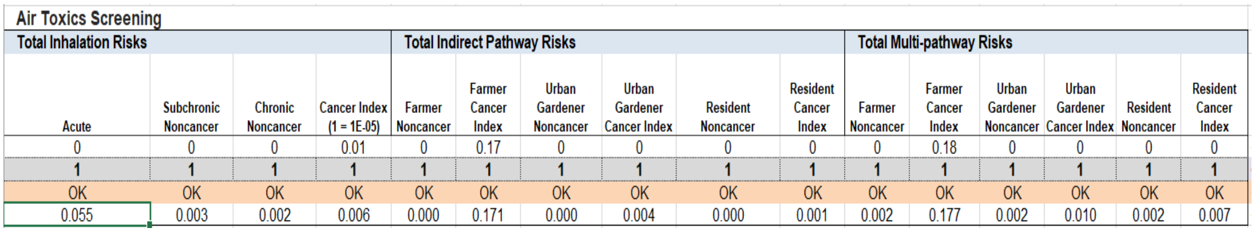
RASS Formulations to Calculate Cumulative Health Risk

Emission rate entered by user in 'Emissions (start here)' tab
AERMOD unit dispersion result entered in 'Dispersion' tab (µg/m^3 / g/s)

NO_2 concentration calculated in 'Concs' tab = 18.41 µg/m^3
NO_2 Acute Toxicity Value in 'Tox Values' tab = 470 µg/m^3 MDH HBV[51]
Acute Inhalation Risk (unitless) calculated in 'Risk Calcs' tab = 18.41 / 470 = 0.039
Acute Inhalation Risk calculated for all acute pollutants and summed in 'Risk Calcs' tab = 0.05[52]

$PM_{2.5}$ is a surrogate for Diesel Exhaust Particulate (DEP)
$PM_{2.5}$ concentration calculated in 'Concs' tab = 0.00068 µg/m^3
DEP Toxicity Value in 'Tox Values' tab = 5 µg/m^3 MDH HRV[i]
Non-Cancer Chronic Risk calculated in 'Risk Calcs' tab = 0.00068 / 5 = 0.00014
Non-Cancer Chronic Risk calculated for all non-cancer chronic pollutants and summed in 'Risk Calcs' tab = 0.002[53]

The Air Toxics Screening Summary table from the 'Summary' tab in the RASS shown below indicates the project's potential impacts are well below all guidance levels.



Air Toxics Screening

Total Inhalation Risks				Total Indirect Pathway Risks						Total Multi-pathway Risks					
Acute	Subchronic Noncancer	Chronic Noncancer	Cancer Index (1 = 1E-05)	Farmer Noncancer	Farmer Cancer Index	Urban Gardener Noncancer	Urban Gardener Cancer Index	Resident Noncancer	Resident Cancer Index	Farmer Noncancer	Farmer Cancer Index	Urban Gardener Noncancer	Urban Gardener Cancer Index	Resident Noncancer	Resident Cancer Index
0	0	0	0.01	0	0.17	0	0	0	0	0	0.18	0	0	0	0
1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
0.055	0.003	0.002	0.006	0.000	0.171	0.000	0.004	0.000	0.001	0.002	0.177	0.002	0.010	0.002	0.007

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[51] Minnesota Department of Health – Health Based Value
[52] Arsenic Risk is 0.006; Benzene Risk is 0.005
[53] Benzene Risk is 0.0008; Manganese Risk is 0.0002

Multi-pathway risks represent the total pollutant exposure from both inhalation and ingestion through meat or plant consumption. In its calculation of maximum exposure due to ingestion, the RASS assumes that a nearby “farmer” lives exclusively on food grown on their farm for 40 years. The multi-pathway cancer risk of 0.18 was almost entirely due to total polycyclic aromatic hydrocarbons (PAH) emissions from the Unit 2 CT (0.17). This risk value reflects a very conservative scenario because the modeling assumed continuous fuel oil operations at the maximum potential hourly emission rate from December-February (i.e., no adjustment for expected hours of operation per year being 75 hours or less). Even these overestimated risk estimates demonstrate the project impacts do not significantly contribute to adverse health outcomes for the immediate and surrounding communities.

Appendix C Construction Assumptions for Greenhouse Gas Calculations

Primary Activities

- Two tanks – one month per tank
- Siemens skids
- Pump house building extension
- Total of 30 weeks

Equipment	Quantity	Use	Fuel (Diesel) Usage Rate
Crane 1 – Tank Erection	1	40 hrs/week * 8 weeks	16 liter/hr
Crane 2 – Building Erection	1	40 hrs/week * 8 weeks	16 liter/hr
Skid steer	2	20 hrs/week * 16 weeks	1 gal/hr
Trencher – Underground Piping	1	40 hrs/week * 8 weeks	10 gal/hr
Trencher –Building Foundations	1	40 hrs/week * 8 weeks	10 gal/hr
Trencher – Tank Foundations	1	40 hrs/week * 8 weeks	10 gal/hr
Aggregate Transport	100	2 hr/truck	4 gal/hr/truck

Deliveries	No. Trucks	Distance	Fuel and Assumed Miles/Gal
Pipes	10	From MPLS – 100 miles round trip	7.3 mpg (diesel)
Tanks	20	From MPLS – 100 miles round trip	7.3 mpg (diesel)
Equipment	10	From MPLS – 100 miles round trip	7.3 mpg (diesel)
Contractors	10* (1,500)	20 miles round trip	17.6 mpg (gasoline)

* Assumes 10 cars, 5 days per week for 30 weeks

Equipment fuel use average from Google search. Aggregate includes rock, asphalt, concrete, and other materials. Time per truck includes 1 hour onsite and 1 hour travel.

Miles per gallon and fuel usage rate for deliveries and contractors derived from EPA's Simplified GHG Emissions Calculator. This includes an estimated average number of contractors per week over construction period. Contractor round trip assumes several contractors will be from Cambridge.

Trencher and skid steer emissions account for all miscellaneous construction equipment sources not otherwise specified (e.g., welding, turbine retrofit).

Appendix D EJScreen Report

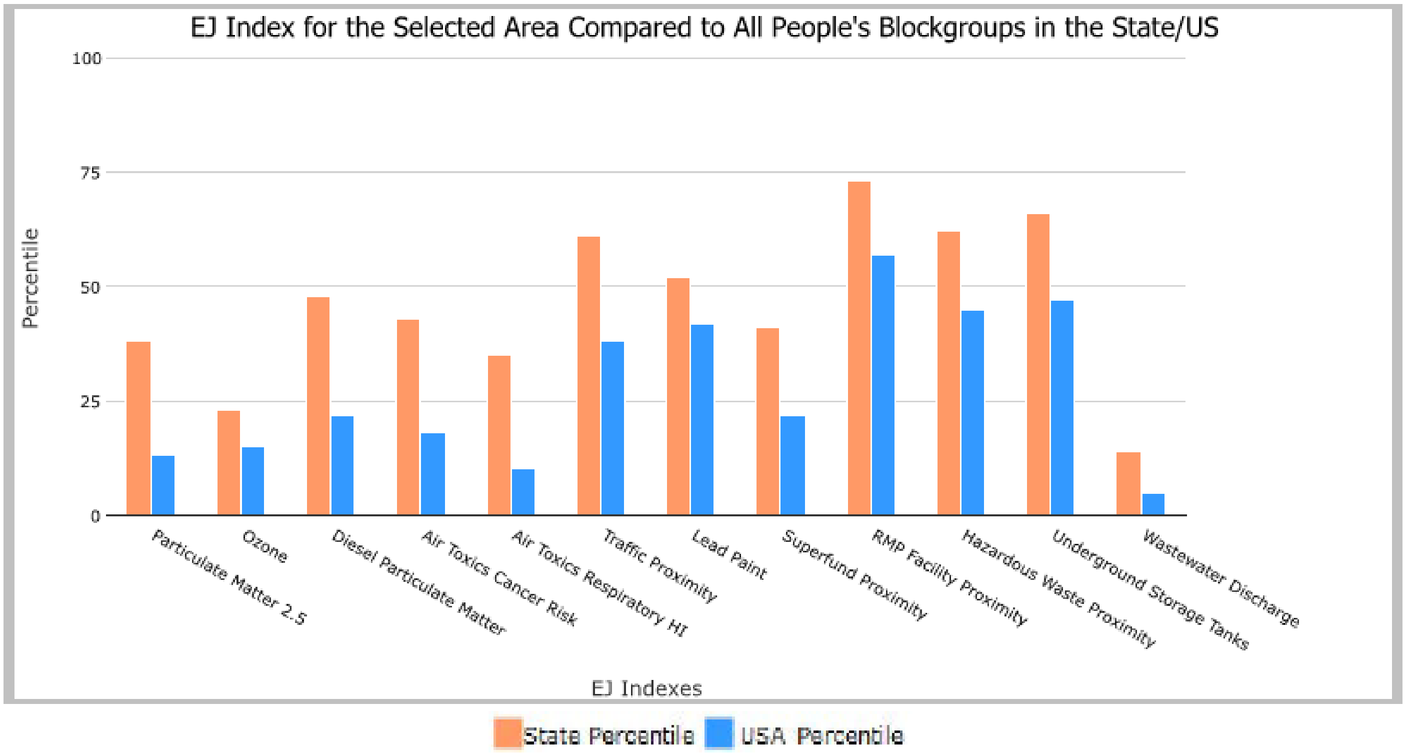
EJScreen Report (Version 2.1)

Tract: 27059130302, MINNESOTA, EPA Region 5

Approximate Population: 2,742

Input Area (sq. miles): 14.41

Selected Variables	State Percentile	USA Percentile
Environmental Justice Indexes		
EJ Index for Particulate Matter 2.5	38	13
EJ Index for Ozone	23	15
EJ Index for Diesel Particulate Matter*	48	22
EJ Index for Air Toxics Cancer Risk*	43	18
EJ Index for Air Toxics Respiratory HI*	35	10
EJ Index for Traffic Proximity	61	38
EJ Index for Lead Paint	52	42
EJ Index for Superfund Proximity	41	22
EJ Index for RMP Facility Proximity	73	57
EJ Index for Hazardous Waste Proximity	62	45
EJ Index for Underground Storage Tanks	66	47
EJ Index for Wastewater Discharge	14	5



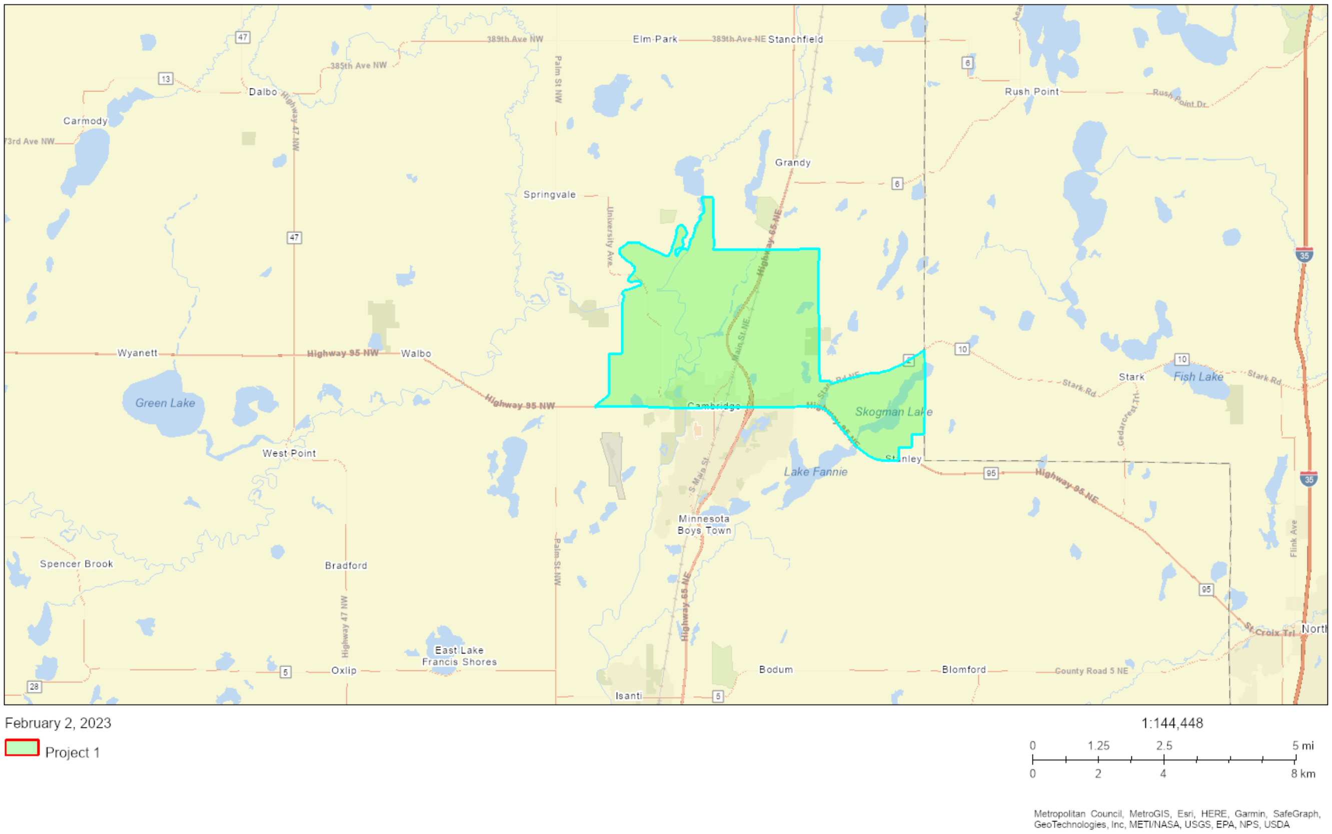
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJScreen Report (Version 2.1)

Tract: 27059130302, MINNESOTA, EPA Region 5

Approximate Population: 2,742

Input Area (sq. miles): 14.41



February 2, 2023

🟩 Project 1

1:144,448

0 1.25 2.5 5 mi

0 2 4 8 km

Metropolitan Council, MetroGIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	1

EJScreen Report (Version 2.1)

Tract: 27059130302, MINNESOTA, EPA Region 5

Approximate Population: 2,742

Input Area (sq. miles): 14.41

Selected Variables	Value	State Avg.	%ile in State	USA Avg.	%ile in USA
Pollution and Sources					
Particulate Matter 2.5 (μg/m^3)	6.84	7.51	24	8.67	11
Ozone (ppb)	36.9	37.7	16	42.5	16
Diesel Particulate Matter* (μg/m^3)	0.121	0.22	33	0.294	<50th
Air Toxics Cancer Risk* (lifetime risk per million)	20	25	55	28	<50th
Air Toxics Respiratory HI*	0.2	0.29	37	0.36	<50th
Traffic Proximity (daily traffic count/distance to road)	200	510	61	760	47
Lead Paint (% Pre-1960 Housing)	0.22	0.3	43	0.27	49
Superfund Proximity (site count/km distance)	0.024	0.19	27	0.13	23
RMP Facility Proximity (facility count/km distance)	1.9	0.79	88	0.77	88
Hazardous Waste Proximity (facility count/km distance)	0.95	1.6	56	2.2	55
Underground Storage Tanks (count/km^2)	1.4	1.8	64	3.9	52
Wastewater Discharge (toxicity-weighted concentration/m distance)	1.6E-07	0.034	9	12	4
Socioeconomic Indicators					
Demographic Index	18%	22%	53	35%	28
People of Color	5%	21%	26	40%	14
Low Income	30%	23%	71	30%	54
Unemployment Rate	4%	4%	66	5%	53
Limited English Speaking Households	0%	2%	0	5%	0
Less Than High School Education	5%	7%	53	12%	35
Under Age 5	4%	6%	28	6%	35
Over Age 64	26%	16%	83	16%	82

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

Appendix E Report of Geotechnical Exploration

REPORT OF GEOTECHNICAL EXPLORATION

Cambridge Unit 2 Dual Fuel Conversion Project
2438 349th Avenue NE
Cambridge, Minnesota

AET Project No. P-0005785

Date: February 2, 2022

Prepared for:
Great River Energy
12300 Elm Creek Boulevard
Maple Grove, Minnesota 55369

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
550 Cleveland Avenue North
St. Paul, MN 55114-1804
TeamAET.com • 800.792.6364

AMERICAN
ENGINEERING TESTING

February 2, 2022

Great River Energy
12300 Elm Creek Boulevard
Maple Grove, Minnesota 55369

Attn: Vincent Herda (vherda@grenergy.com)

RE: Geotechnical Exploration
Cambridge Unit 2 Dual Fuel Conversion Project
2438 349th Avenue NE
Cambridge, Minnesota
AET Report No. P-0005785

Dear Mr. Herda;

American Engineering Testing, Inc. (AET) is pleased to present this report of the subsurface exploration program we completed for the Cambridge Unit 2 Dual Fuel Conversion Project in Cambridge, Minnesota (GRE Purchase Order 6183590).

We are submitting this report as an electronic pdf copy. Please contact me if you have any questions about the report or if anything else is needed.

Sincerely,
American Engineering Testing, Inc.

Jay Brekke

Jay P. Brekke, PE (MN)
jbrekke@TeamAET.com
651.789.4645

550 Cleveland Avenue North | Saint Paul, MN 55114
Phone (651) 659-9001 | (800) 972-6364 | Fax (651) 659-1379 | teamAET.com | AA/EEO

SIGNATURE PAGE

AMERICAN
ENGINEERING TESTING

Prepared for:

Great River Energy
12300 Elm Creek Boulevard
Maple Grove, MN 55369

Attn: Vincent Herda

Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
(651) 659-9001/www.teamAET.com

Authored by:

Jay Brekke

Jay P. Brekke, PE
Senior Engineer

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under Minnesota Statute Section 326.02 to 326.15

Name: Jay P. Brekke

Date: February 2, 2022 License #: 25631

Reviewed by:

Joseph G. Bentler

Joseph G. Bentler, PE
Principal Geotechnical Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION

Great River Energy (GRE) is planning the installation of two new above-ground tanks at GRE's plant at 2438 349th Avenue NE in Cambridge, Minnesota. To assist with planning and design, GRE has authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site. This report presents the results of these services, and it provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to GRE dated August 31, 2021, which was authorized on September 10, 2021 (PO #6183590). AET's authorized scope of services consisted of the following:

- Drilling six Standard Penetration Test (SPT) borings, to depths of about 20 feet each or refusal due to obstruction or bedrock;
- Performing two seismic piezocone penetration (CPTu) tests to a depth of 75 feet (or to refusal);
- Performing soil laboratory testing; and,
- Providing a geotechnical engineering review based on the data and preparing this report.

3.0 PROJECT INFORMATION

We understand that the Cambridge Unit 2 Dual Fuel Conversion project includes the installation of two new above-ground tanks (a demineralization water tank and a fuel oil tank). We understand these are planned to be steel tanks supported on ringwall footings. Grading plans have not been developed. We anticipate relatively minor grade changes in the tank footprints.

The demineralization water (demin) tank will be constructed north of the fuel oil tank and will have a diameter of 45 feet and a height of 36 feet. The demin tank and contents will have a total weight of approximately 4062 kips. The fuel oil tank will have a diameter of 53 feet and a height of 28 feet, and a total weight of 3933 kips. We assume the bearing pressure for the tank foundations will be less than 3000 psf.

Our foundation design assumptions include a minimum factor of safety of 3 with respect to the ultimate soil bearing capacity. We assume the structures will be able to tolerate total and differential settlements of up to 1-inch and ½-inch, respectively.

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project by AET consisted of 6 SPT borings (numbered B-16 through B-21) and 2 CPTu soundings (numbered C-04 and C-05). AET recommended the boring and sounding locations and depths. Ulteig Engineers, Inc. staked the borings and soundings and determined the ground surface elevations. Due to a sloped ground surface, Boring 16 was drilled approximately 10 feet south of the staked location. Our drill crew determined the ground surface elevation at the offset location using an engineer's level. The offset ground surface elevation was referenced to the ground surface elevation at the stake. The approximate as-drilled boring and sounding locations are shown on Figure 1 in Appendix A.

The piezocone penetration test soundings were performed using a 15 cm^2 electronic cone, with an end area ratio of 0.81. A description of the CPTu test procedure is included in Appendix A. With the CPTu test method, soil layers are classified by soil behavior type (SBT) instead of grain size distribution and plasticity, because soil samples are not obtained by this test. The SBT uses a relationship between normalized cone tip resistance (QT) and friction ratio (FR) to classify the soil type into nine different categories. The graphical CPTu logs contain information about sleeve friction, tip resistance, friction ratio, pore pressure and soil behavior type (SBT) classification.

For clarification of the results, we are also including the CPTu soundings in a format which resembles a traditional soil boring log (Appendix A). These logs include an interpreted soil description and an estimated N-value. We estimated the interpreted soil descriptions based on the CPTu data, along with comparison with the results of the soil borings that we drilled on this site. The estimated N-values are based on correlations with cone tip stress; this correlation is based on published values in the literature and our local experience.

At each of the CPTu sounding locations, we also performed downhole shear wave velocity testing at approximate 5-foot depth intervals. During a normal piezocone sounding (where tip resistance, sleeve friction, and pore pressure are measured), the sounding is paused at specified depths where shear (S) wave velocities are measured. The S wave source was a metal beam pressed against the ground surface. The S waves were generated by striking the beam with a hammer having an electronic trigger. The measured S wave velocities can be used to evaluate the stress-strain modulus of the various soil layers. The seismic shear wave velocity results are included in Appendix A.

The logs of the borings and soundings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic description, and moisture condition. Relative density is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

4.2 Laboratory Testing

The recovered samples were returned to our laboratory where we visually/manually classified each sample based on texture and plasticity in accordance with the Unified Soil Classification System (USCS). Sheets describing the USCS and the descriptive terminology and symbols used on the boring logs are also included in Appendix A. The laboratory test program included 3 sieve analysis tests. The test results appear in Appendix A on the boring logs adjacent to the samples upon which they were performed and on the Gradation Curve data sheet following the logs.

5.0 SITE CONDITIONS

5.1 Surface Observations

At the time of our field exploration the site of the proposed demin tank was gravel-surfaced and relatively flat. The elevations at our borings/soundings for the demin tank ranged from 946.4 to 947.3 feet. There was an existing above-ground tank on the north side of the proposed demin tank.

At the time of our field exploration the site of the proposed fuel oil tank was grass/weed covered. The ground surface elevation drops about 4 feet from the east side of the planned tank to the west side. The elevations at our borings ranged from 946.1 to 950.2 feet.

5.2 Subsurface Soils/Geology

At our borings/soundings we found fill or possible fill to depths ranging from about 2 to 7 feet. The fill consists mostly of brown and dark brown silty sand. Some of the fill contains trace roots or organics. Underlying the fill, we found mostly coarse alluvial soils to the boring/sounding termination depths. The coarse alluvium consists of mostly sands and silty sands. At the two soundings, we found some layers of fine alluvial silt and lean clay below about 35 feet.

5.3 Groundwater

Groundwater was measured in all 6 borings at the time of drilling, mostly in sand soils. The measured groundwater levels ranged from about 13 to 18 feet below grade, which corresponds to elevations ranging from approximately 931½ to 933 feet. Due to their fast-draining nature, we generally consider groundwater measurements in sand soils to reliably represent the approximate static groundwater levels at the time of drilling.

Groundwater levels are not directly measured when performing CPTu soundings. Rather, the pore water pressure generated during the push of the cone is measured. In clean, saturated sands the measured pore pressures may be equal to hydrostatic groundwater pressures, while in saturated clays the pore pressure response is typically in excess of hydrostatic pressure. In our opinion, the measured pore water pressure measurements measured in the sand layers in the CPTu soundings correspond to groundwater levels ranging from about 16 to 19 feet below grade, which is somewhat deeper than the groundwater levels measured in the soil borings. This may indicate a slight downward gradient in groundwater at the site. However, the shallower groundwater levels indicated by the soil borings are judged to be more representative of conditions that would affect excavations.

Groundwater levels do not remain static and fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors. A discussion of the water level measurement methods is presented in Appendix A.

5.4 Review of Soil Properties

5.4.1 Fill

The fill consists of mostly of brown and dark brown silty sand. The fill is undocumented, and in our opinion should not be relied upon for the support of the tanks. The fill is considered mostly moderately slow draining and susceptible to freeze-thaw movements.

5.4.2 Coarse Alluvium

In our opinion, the coarse alluvial soils have moderate strength and low compressibility under the anticipated loads. The silty sands are considered moderately slow draining and susceptible to freeze-thaw movements if exposed to freezing temperatures. The sand and sand with silt soils are fast draining and are not judged to be significantly susceptible to freeze-thaw movements.

5.4.3 Fine Alluvium

Silt

Layers of silt were found in some borings/soundings. The silt layers were encountered deeper than about 55 feet. In our opinion, the silts have moderate strength and low compressibility under the anticipated loads. The silts are considered slow to moderately slow draining and highly susceptible to freeze-thaw movements if exposed to freezing temperatures.

Clay

Layers of lean clay were found in the two soundings. The clay layers were encountered deeper than about 35 feet. In our opinion, these clay soils have moderate strength and low compressibility under the anticipated loads. The clays are considered slow draining and susceptible to freeze-thaw movements if exposed to freezing temperatures.

6.0 RECOMMENDATIONS

6.1 Discussion

We found what we classify as fill to about 2 to 7 feet below grade at our borings/soundings. The fill is undocumented; that is, there are no records of observation or testing during its placement. In our opinion, the fill should not be relied upon for supporting the tanks. We recommend performing conventional soil correction to prepare the building pads. After proper site preparation the proposed tanks can be supported on conventional spread footing foundations (ringwall footings).

Some of the on-site soils are silty and are frost susceptible. In addition to removing and replacing the existing fill soils, we recommend subcutting any frost susceptible soils (all soils not classified as SP or SP-SM) to at least 5 feet below proposed finished exterior grade. We recommend that new fill required below the tanks consist of non-frost susceptible (NFS) sand containing less than 8% passing the #200 sieve and no more than 40% passing the #40 sieve.

Details of our recommendations are given below.

6.2 Grading

6.2.1 Excavation

The site preparation for the tanks should consist of removing the existing vegetation, as well as excavating the existing fill and any organic or unsuitable soils that may be present. The subcutting should extend down to the competent non-organic sand or silty sand soils. The following table presents our estimated minimum depths of subcutting to remove fill at the boring locations.

Table 6.2.1 – Estimated Excavation Depths to Remove Existing Fill

Boring/Sounding	Surface Elevation (ft)	Estimated Excavation Depth (ft)	Approximate Excavation Elevation (ft)
B-16	950.2	4½	945½
B-17	946.1	2	944
B-18	949.8	7	943
B-19	946.7	2	944½
B-20	947.3	2	945½
B-21	946.4	3	943½
C-04	949.8	5	945
C-05	947.0	3	944

As discussed in Section 6.1, we also recommend removing any frost susceptible soils (all soils not classified as SP or SP-SM) to at least 5 feet below proposed finished exterior grade. The actual required depths of subcutting will need to be determined during earthwork. This should be determined by a geotechnical engineer performing observation and testing during site preparation. The lateral zone of subcutting should be extended out horizontally at least 1 foot from the outside edges of footings for every foot of fill required below the base of the footings (i.e., 1:1 lateral oversize).

Care must be taken when excavating near the existing tank to avoid undermining its foundation. The excavation should not extend below an imaginary line extending out 2 feet laterally from the base of the existing footings and then downward and outward at a 1:1 slope. Normally, the soils below this imaginary line would be native soils or compacted fill materials placed specifically for support of the existing construction and would not require re-excavation. However, if these soils are judged to be unsuitable for tank support, some form of retention system or underpinning of the existing foundation could be needed.

6.2.2 Filling

We recommend using imported NFS sands as new fill below the tanks. We recommend using non-organic sands containing less than 8% passing the #200 sieve and no more than 40% passing the #40 sieve.

Fill below the tanks should be placed in thin lifts and compacted to at least 100% of its standard maximum dry unit weight per ASTM: D698 (Standard Proctor test). Fill should not be placed over frozen soils and frozen soils should not be used as fill. Sand fill can be placed and compacted with loose lifts of about 8 to 12 inches, depending on the size of the compactor being used. This should be reviewed in the field at the time of construction. For compaction of sands, a combination of weight and vibration from the compactor is more effective than static (non-vibratory) compaction.

6.3 Foundation Design

Based on the conditions found in our borings and our recommended grading/compaction procedures, it is our opinion that the footings may be proportioned for a maximum net allowable soil bearing pressure of 3,000 pounds per square foot. The factor of safety with respect to the ultimate soil bearing capacity for this design will exceed 3. We judge that total and differential settlements under this loading should not exceed 1-inch and ½-inch, respectively.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 *Potential Difficulties*

7.1.1 Groundwater

Runoff water might be encountered in open excavations during grading. To allow observation of the excavation bottom, and to reduce the potential for soil disturbance and facilitate filling operations, we recommend that all free-standing water within the excavations be removed prior to proceeding with construction.

7.1.2 Winter Construction

If construction occurs during the winter, it is necessary for the contractor to protect the base soils from freezing each day and each night before new fill is placed. Fill should not be placed over frozen soils, snow, or ice, nor should the use of frozen fill soils be permitted. The contractor must protect base soils from freezing before and after fill placement, and before, during, and after concrete placement.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes per *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or running which could require slope maintenance.

7.3 Observations and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring and sounding locations. Because soil conditions can vary away from the soil boring and CPT sounding locations, we recommend on-site observations by AET geotechnical personnel during construction to evaluate these potential changes.

8.0 ASTM STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

9.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, we have endeavored to provide our services according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, express or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled "Geotechnical Report Limitations and Guidelines for Use."

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Electronic Friction Cone and Piezocone Penetration Testing
Figure 1 – Boring and Sounding Location Diagram
Subsurface Boring & CPTu Logs
Gradation Curves
Shear Wave Velocity Results

Appendix A
Geotechnical Field Exploration and Testing
Report No. P-0005785

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling 6 standard penetration test borings and 2 CPTu soundings. The locations of the borings and soundings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The most recent drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as “DS” or “SU” on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of “topsoil” layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The groundwater level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Sieve Analysis of Soils (thru #200 Sieve)

Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

A.8 PIEZOCONE PENETRATION TEST (CPTu) METHODS

The test method is described in ASTM: D5778. This cone test method determines the resistance to penetration of a conical pointed penetrometer and the frictional resistance of a cylindrical sleeve located behind the conical point as the cone is advanced through subsurface soils at a slow and steady rate. The piezocone adds the measurement of pore pressure development behind the tip. The equipment provides a detailed record of cone resistance which is useful for evaluation of site stratigraphy, homogeneity and depth to firm layers, voids or cavities, and other discontinuities. In addition, the cone resistance and friction data can be used to estimate soil classification, and correlations with engineering properties of soils. The pore pressure readings also provide information on soil type and water table depth. Pore pressure dissipation, after a push, can also be monitored for correlation to soil consolidation and permeability. Therefore, the test provides a rapid means for determining subsurface conditions and can be used for estimating engineering properties of soils for structures, and the behavior of soils under static and dynamic loads.

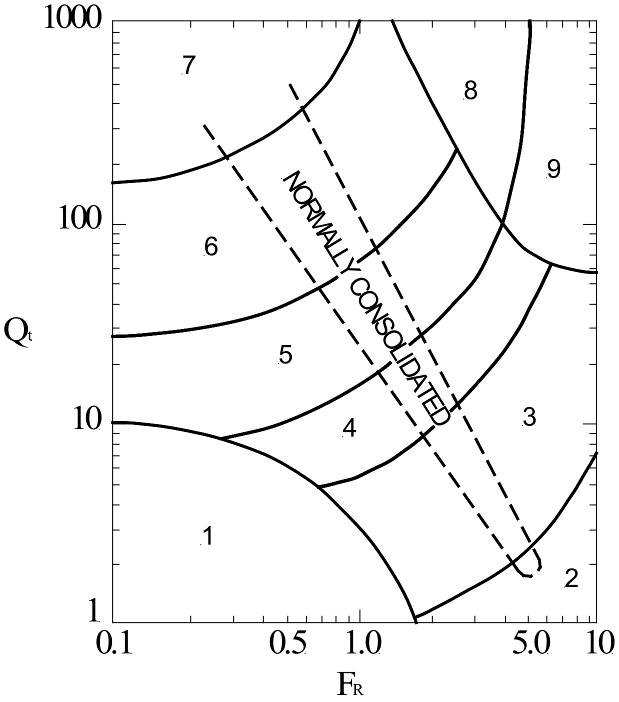
During the testing, a penetrometer tip with a conical point having a 60° apex angle and a cone base area of 10 cm2 or 15cm2 is advanced through the soil at a constant rate of 2 cm/sec. The friction sleeve is present on the penetrometer immediately behind the cone tip. The forces exerted on the conical point (cone) and the friction sleeve required to penetrate the soil are measured by electrical methods, at every 2 cm of penetration. The cone resistance (qt) is calculated by dividing the measured total cone force by the cone base area. The friction sleeve resistance (fs) is obtained by dividing the measured force exerted on the sleeve by its surface area. Pore pressure is measured directly behind the cone (U2 position).

A.9 CPTu SOIL BEHAVIOR TYPE

Soil Classification methods for the Cone Penetration Test is based on correlation charts developed from observations of CPT data and conventional borings. Please note that these classification charts are meant to provide a guide to Soil Behavior Type and should not be used to infer a soil classification based on grain size distribution.

The following chart is used to provide a Soil Behavior Type of the CPT Data.

Figure 1: Robertson CPT 1990 (Soil Behavior Type based on Friction Ratio)



The numbers corresponding to different regions on the Charts represent the following soil behavior types:

1. Sensitive, Fine Grained
2. Organic Soils - Peats
3. Clays - Clay to Silty Clay
4. Silt Mixtures - Clayey Silt to Silty Clay
5. Sand Mixtures - Silty Sand to Sandy Si1t
6. Sands - Clean Sand to Silty Sand
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff, Fine Grained

$$Q_t = \frac{q_t - \sigma_{vo}}{\sigma'_{vo}} \quad F_R = \frac{f_s}{q_t - \sigma_{vo}} \times 100\%$$

where . . .
Q_T.......... normalized cone resistance
F_R .... normalized friction ratio

Note that engineering judgment and comparison with conventional borings is especially important in the proper interpretation of CPT data in certain geo-materials.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B, H, N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1d" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

(Calibrated Hammer Weight)

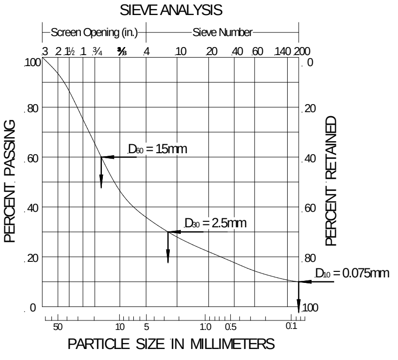
The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N_{60} values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

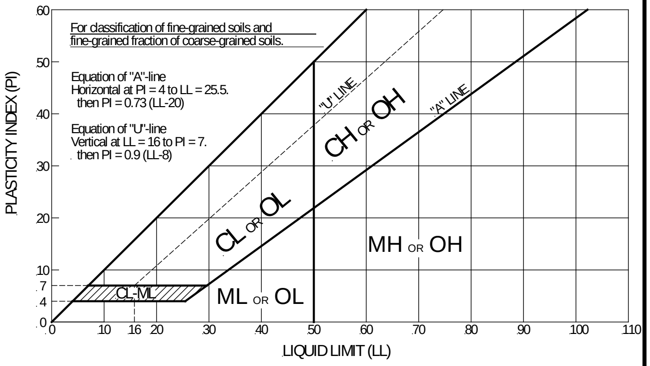
UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu≥4 and 1≤Cc≤3[E]	GW	Well graded gravel[F]
			Cu<4 and/or 1>Cc>3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel[F.G.H]
			Fines classify as CL or CH	GC	Clayey gravel[F.G.H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu≥6 and 1≤Cc≤3[E]	SW	Well-graded sand[I]
			Cu<6 and/or 1>Cc>3[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand[G.H.I]
			Fines classify as CL or CH	SC	Clayey sand[G.H.I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K.L.M]
			PI<4 or plots below "A" line[J]	ML	Silt[K.L.M]
		organic	$\frac{\text{Liquid limit–oven dried}}{\text{Liquid limit – not dried}} <0.75$	OL	Organic clay[K.L.M.N] Organic silt[K.L.M.O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K.L.M]
			PI plots below "A" line	MH	Elastic silt[K.L.M]
		organic	$\frac{\text{Liquid limit–oven dried}}{\text{Liquid limit – not dried}} <0.75$	OH	Organic clay[K.L.M.P] Organic silt[K.L.M.Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]



$$C_u = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200 \qquad C_c = \frac{(D_{30})^2}{D_{10} \text{ x } D_{60}} = \frac{2.5^2}{0.075 \text{ x } 15} = 5.6$$



Plasticity Chart

Notes

[A] Based on the material passing the 3-in (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E] $Cu = D_{60} /D_{10},$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \text{ x } D_{60}}$

[F] If soil contains ≥15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot is hatched area, soil is a CL-ML silty clay.

[K] If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L] If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M] If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI≥4 and plots on or above "A" line.

[O] PI<4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

[R] Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition
(MC Column)

D (Dry):	Absence of moisture, dusty, dry to touch.
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").
W (Wet/ Waterbearing):	Free water visible, intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
F (Frozen):	Soil frozen

Layering Notes

Laminations:	Layers less than ½" thick of differing material or color.
Lenses:	Pockets or layers greater than ½" thick of differing material or color.

Peat Description

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

ELECTRONIC FRICTION CONE AND PIEZOCONE PENETRATION TESTING

TEST PROCEDURE

The test method is described in ASTM: D5778. This cone test method determines the resistance to penetration of a conical pointed penetrometer and the frictional resistance of a cylindrical sleeve located behind the conical point as the cone is advanced through subsurface soils at a slow and steady rate. The piezocone adds the measurement of pore pressure development behind the tip. The equipment provides a detailed record of cone resistance which is useful for evaluation of site stratigraphy, homogeneity and depth to firm layers, voids or cavities, and other discontinuities. In addition, the cone resistance and friction data can be used to estimate soil classification, and correlations with engineering properties of soils. The pore pressure readings also provide information on soil type and water table depth. Pore pressure dissipation, after a push, can also be monitored for correlation to soil consolidation and permeability. Therefore, the test provides a rapid means for determining subsurface conditions, and can be used for estimating engineering properties of soils for structures, and the behavior of soils under static and dynamic loads.

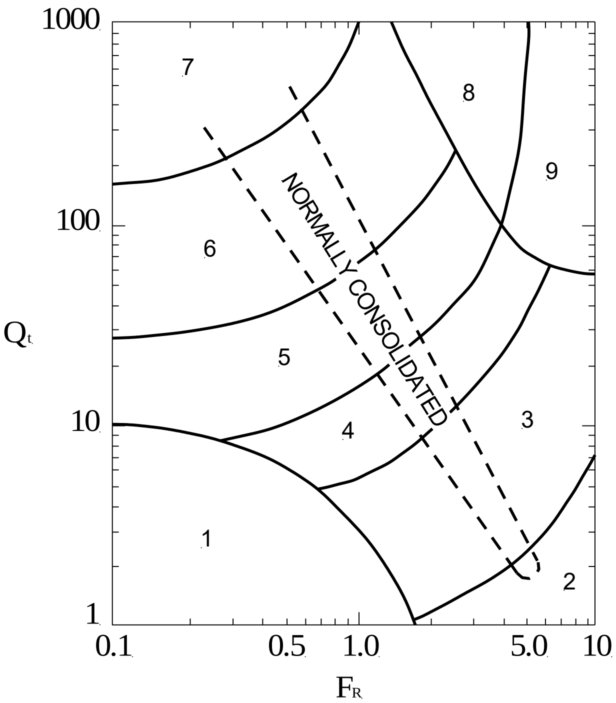
During the testing, a penetrometer tip with a conical point having a 60° apex angle and a cone base area of 10 cm^2 or $15cm^2$ is advanced through the soil at a constant rate of 2 cm/sec. The friction sleeve is present on the penetrometer immediately behind the cone tip. The forces exerted on the conical point (cone) and the friction sleeve required to penetrate the soil are measured by electrical methods, at every 2 cm of penetration. The cone resistance (q_t) is calculated by dividing the measured total cone force by the cone base area. The friction sleeve resistance (f_s) is obtained by dividing the measured force exerted on the sleeve by its surface area. Pore pressure is measured directly behind the cone (U_2 position).

SOIL BEHAVIOR TYPE (SBT)

Soil Classification methods for the Cone Penetration Test is based on correlation charts developed from observations of CPT data and conventional borings. Please note that these classification charts are meant to provide a guide to Soil Behavior Type and should not be used to infer a soil classification based on grain size distribution.

The following chart is used to provide a Soil Behavior Type of the CPT Data.

Figure 1: Robertson CPT 1990 (Soil Behavior Type based on Friction Ratio)



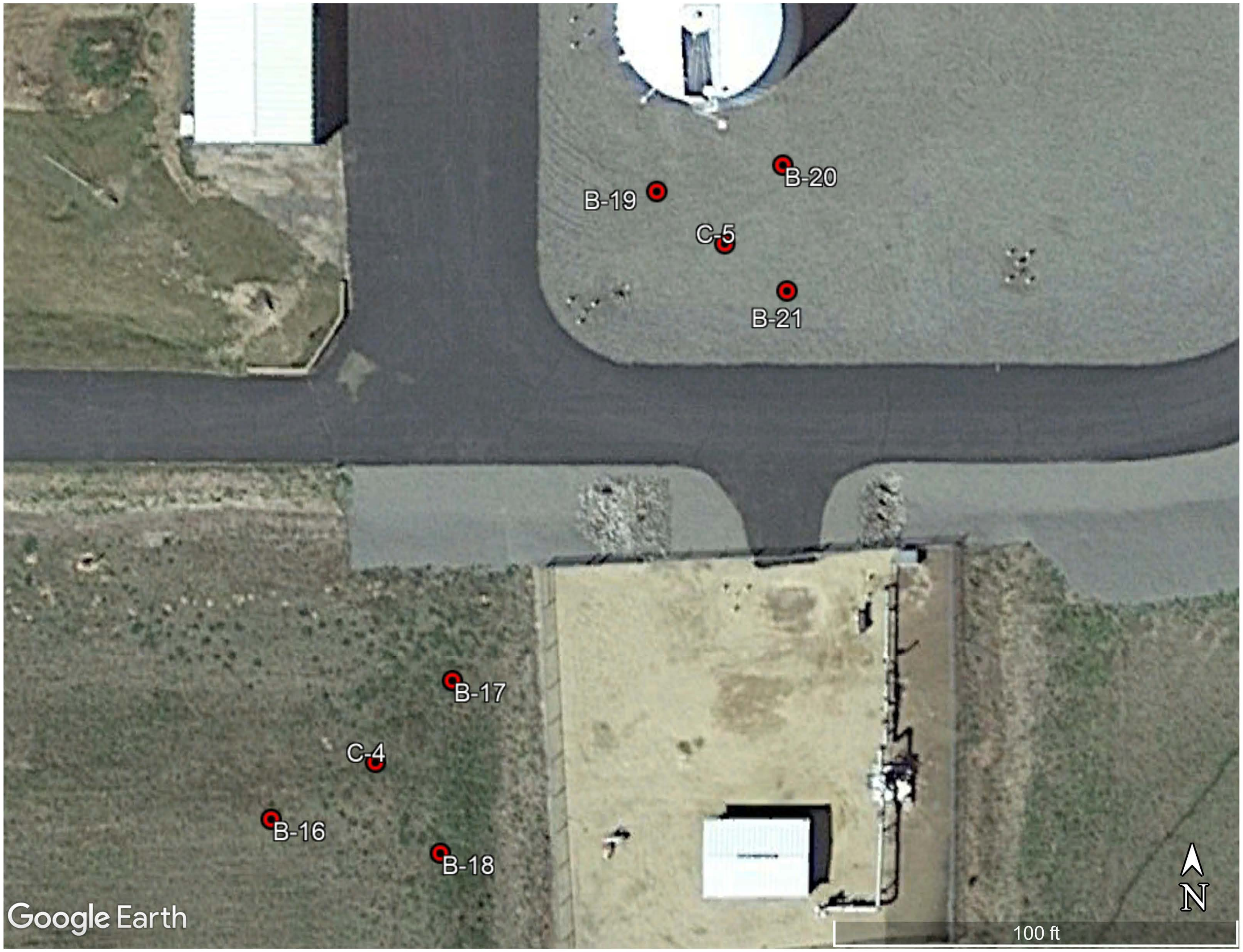
The numbers corresponding to different regions on the charts represent the following soil behavior types:

1. Sensitive, Fine Grained
2. Organic Soils - Peats
3. Clays - Clay to Silty Clay
4. Silt Mixtures - Clayey Silt to Silty Clay
5. Sand Mixtures - Silty Sand to Sandy Si1t
6. Sands - Clean Sand to Silty Sand
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff, Fine Grained

$$Q_t = \frac{q_t - \sigma_{vo}}{\sigma'_{vo}} \quad F_R = \frac{f_s}{q_t - \sigma_{vo}} \quad \text{x } 100\%$$

where . . .
Q_T..........normalized cone resistance
F_R ....normalized friction ratio

Note that engineering judgment and comparison with conventional borings is especially important in the proper interpretation of CPT data in certain geo-materials.



AMERICAN ENGINEERING TESTING, INC.	**PROJECT** **Cambridge Unit 2 Dual Fuel Conversion** Cambridge, Minnesota			**AET JOB NO.** P-0005785
	SUBJECT **Approximate Boring Locations**			**DATE** January 2022
	SCALE See Above	**PREPARED BY** JPB	**CHECKED BY** JGB	**Figure 1**

SUBSURFACE BORING LOG

AET No: **P-0005785** Log of Boring No. **B-16 (p. 1 of 1)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Surface Elevation **950.2**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand with organic fines, trace roots, dark brown to brown	FILL									
1			4	M	SS	18					
2											
3			4	M	SS	12					
4											
5	SILTY SAND, fine grained, gray, moist, very loose (SM)	COARSE ALLUVIUM	4	M	SS	16					
6											
7	SAND, fine grained, light brown, moist, medium dense to loose (SP)										
8			24	M	SS	18					
9											
10			20	M	SS	18					
11											
12											
13			14	M	SS	16					
14											
15			10	M	SS	14					
16											
17				▼							
18	SAND, fine grained, brown, waterbearing, medium dense (SP)										
19											
20			28	W	SS	18					
21	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-19½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
10/7/21	**12:25**	**21.0**	**19.5**	**19.5**		**18.4**
10/7/21	**12:30**	**21.0**	**19.5**	**19.0**		**17.5**

BORING COMPLETED: **10/7/21**

DR: **GH** LG: **JM** Rig: **69C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0005785.GPJ AET+CPT+WELL.GDT 1/24/22

SUBSURFACE BORING LOG

AET No: **P-0005785**

Log of Boring No. **B-17 (p. 1 of 1)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Surface Elevation **946.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, brown	FILL									
1			11	M	SS	12					
2	SAND, fine grained, light brown, moist, medium dense to loose (SP)	COARSE ALLUVIUM									
3			22	M	SS	24					
4											
5											
			16	M	SS	18					
6											
7											
8			9	M	SS	14					
9											
10											
			10	M	SS	18					
11											
12											
13			12	W	SS	18					
14											
				▼							
	SAND, fine grained, brown, waterbearing, medium dense (SP)										
15			16	W	SS	18					
16											
17											
18	SAND, a little gravel, fine to medium grained, gray, loose (SP)										
19											
20			10	W	SS	18					
21	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-19½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
10/7/21	**1:30**	**21.0**	**19.5**	**19.1**		**17.3**
10/7/21	**1:40**	**21.0**	**19.5**	**18.7**		**14.4**

BORING COMPLETED: **10/7/21**

DR: **GH** LG: **JM** Rig: **69C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0005785.GPJ AET+CPT+WELL.GDT 1/24/22

SUBSURFACE BORING LOG

AET No: **P-0005785** Log of Boring No. **B-18 (p. 1 of 2)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Surface Elevation **949.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	FILL, mostly sand with silt, trace roots, brown	FILL									
1			5	M	SS	18					
2	FILL, mostly silty sand, brown and dark brown										
3			6	M	SS	18					37.7
4											
5											
			6	M	SS	18					
6											
7	SAND, fine grained, light brown, moist, medium dense to loose (SP)	COARSE ALLUVIUM									
8			26	M	SS	20					
9											
10											
			14	M	SS	18					
11											
12											
13			6	M	SS	14					
14											
15											
			6	M	SS	18					
16											
17											
				▼							
18	SAND, fine grained, light brown, waterbearing, very loose (SP)										
19											
20			4	W	SS	18					
21											

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-29½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	10/7/21	**11:10**	**21.0**	**19.5**	**19.2**		**18.4**	
	10/7/21	**11:20**	**21.0**	**19.5**	**19.2**		**18.0**	
BORING COMPLETED: **10/7/21**								
DR: **GH** LG: **JM** Rig: **69C**								

SUBSURFACE BORING LOG

AET No: **P-0005785** Log of Boring No. **B-18 (p. 2 of 2)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	SAND, fine grained, light brown, waterbearing, very loose (SP) *(continued)*	COARSE ALLUVIUM *(continued)*									
23	SAND, a little gravel, fine to medium grained, brown, waterbearing, loose (SP)										
24											
25			9	W	SS	18					
26											
27											
28											
29											
30			10	W	SS	18					
31	**END OF BORING**										

SUBSURFACE BORING LOG

AET No: **P-0005785** Log of Boring No. **B-19 (p. 1 of 1)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

DEPTH IN FEET	Surface Elevation **946.7**	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
	MATERIAL DESCRIPTION						WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, brown	FILL									
1			11	M	SS	16					
2	SILTY SAND, light brown, moist, medium dense to loose (SM)	COARSE ALLUVIUM									
3			14	M	SS	18					22.8
4											
	SAND, fine grained, light brown, moist, loose (SP)										
5											
			9	M	SS	18					
6											
7											
8			10	M	SS	18					
9											
10											
			8	M	SS	16					
11											
12											
13			9	W	SS	18					
14											
	SAND, fine grained, brown, waterbearing, medium dense (SP)										
15			13	W ▼	SS	14					
16											
17											
18	SAND, a little gravel, fine grained, brown, waterbearing, medium dense (SP)										
19											
20			16	W	SS	18					
21	**END OF BORING**										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-19½' **3.25" HSA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	10/7/21	**3:30**	**21.0**	**19.5**	**18.7**		**16.3**	
	10/7/21	**3:40**	**21.0**	**19.5**	**18.5**		**15.4**	
BORING COMPLETED: **10/7/21**								
DR: **GH** LG: **JM** Rig: **69C**								

AET_CORP P-0005785.GPJ AET+CPT+WELL.GDT 1/24/22

SUBSURFACE BORING LOG

AET No: **P-0005785** Log of Boring No. **B-20 (p. 1 of 1)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Surface Elevation **947.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, brown	FILL									
1			12	M	SS	12					
2	SILTY SAND, brown, moist, loose (SM)	COARSE ALLUVIUM									
3			8	M	SS	18					
4											
5											
			7	M	SS	18					17.5
6											
7	SAND, fine grained, light brown, moist to waterbearing, medium dense to loose (SP)										
8			12	M	SS	18					
9											
10											
			14	M	SS	18					
11											
12											
13			8	W	SS	18					
14											
	SAND, fine grained, brown, waterbearing, medium dense (SP)										
15			9	▼ W	SS	16					
16											
17											
18											
19											
20			13	W	SS	18					
21	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-19½'	**3.25" HSA**

BORING COMPLETED: **10/7/21**

DR: **GH** LG: **JM** Rig: **69C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
10/7/21	**4:25**	**21.0**	**19.5**	**17.5**		**16.0**
10/7/21	**4:35**	**21.0**	**19.5**	**17.0**		**15.0**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET No: **P-0005785** Log of Boring No. **B-21 (p. 1 of 1)**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Surface Elevation **946.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
	FILL, mostly silty sand, brown	FILL									
1			6	M	SS	12					
2											
3	SAND, fine grained, light brown, moist, medium dense to loose (SP)	COARSE ALLUVIUM	10	M	SS	16					
4											
5											
6			10	M	SS	0					
7											
8			14	M	SS	16					
9											
10											
11			7	M	SS	12					
12											
13			4	▼	SS	18					
14											
15	SAND, fine grained, brown, waterbearing, loose (SP)		5	W	SS	18					
16											
17											
18	SAND, a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP)										
19											
20			16	W	SS	18					
21	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-19½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
10/7/21	**2:30**	**21.0**	**19.5**	**18.9**		**16.9**
10/7/21	**2:40**	**21.0**	**19.5**	**18.5**		**13.2**

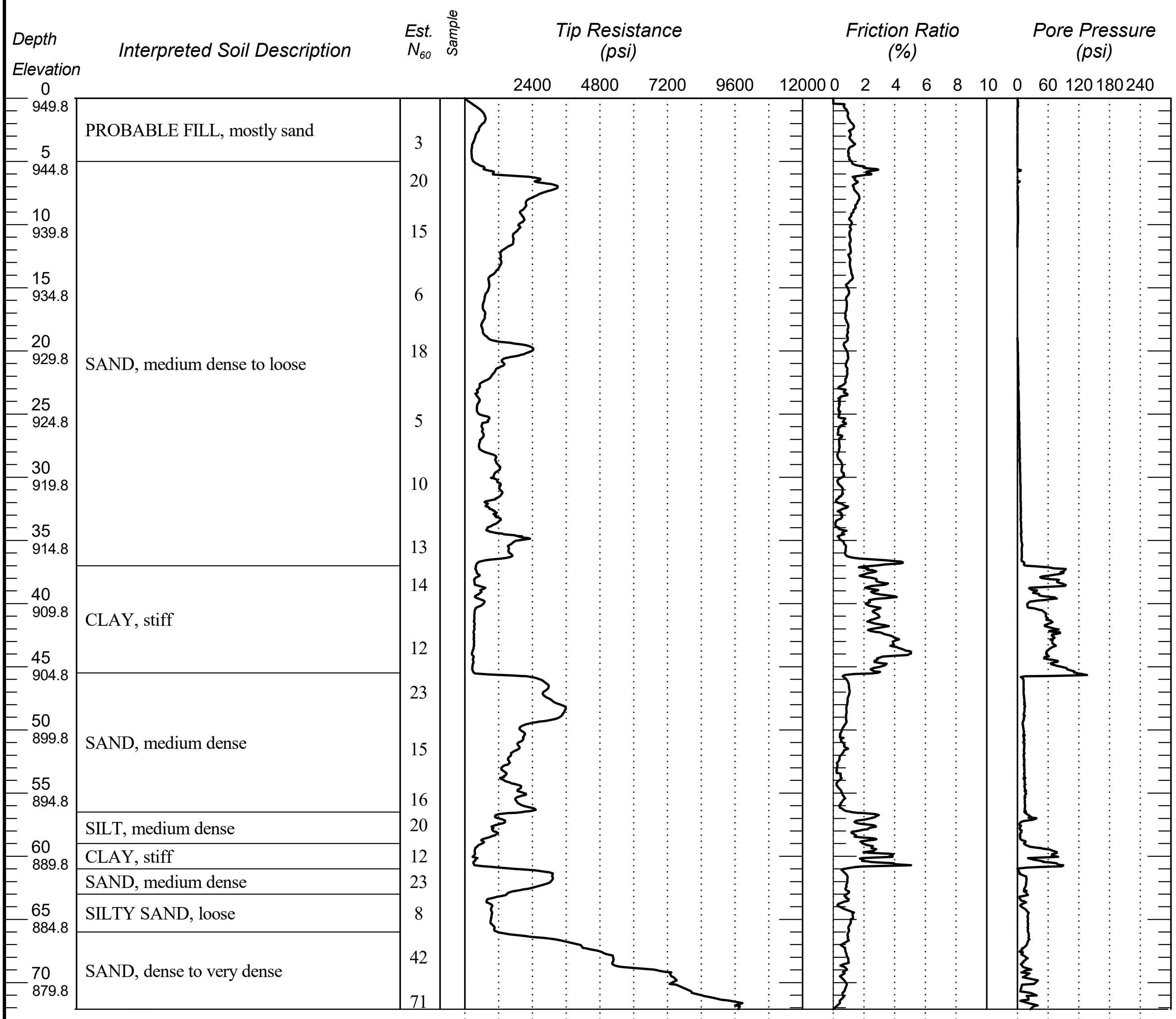
BORING COMPLETED: **10/7/21**

DR: **GH** LG: **JM** Rig: **69C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

CONE PENETRATION TEST RESULTS

AET NO: **P-0005785** Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**		Sounding No. **C-04 (p. 1 of 1)**
Location	CPT Machine **20** CPT Operator **Dave Adams**	Surface Elevation **949.8**
Co. Coordinates: X= Y= (feet)	Cone # **4444.184**	Date Completed: 10/18/21



Bottom of Hole 72.104

CONE PENETRATION TEST RESULTS

AET NO: **P-0005785**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Sounding No. **C-05 (p. 1 of 1)**

Location

CPT Machine **20**

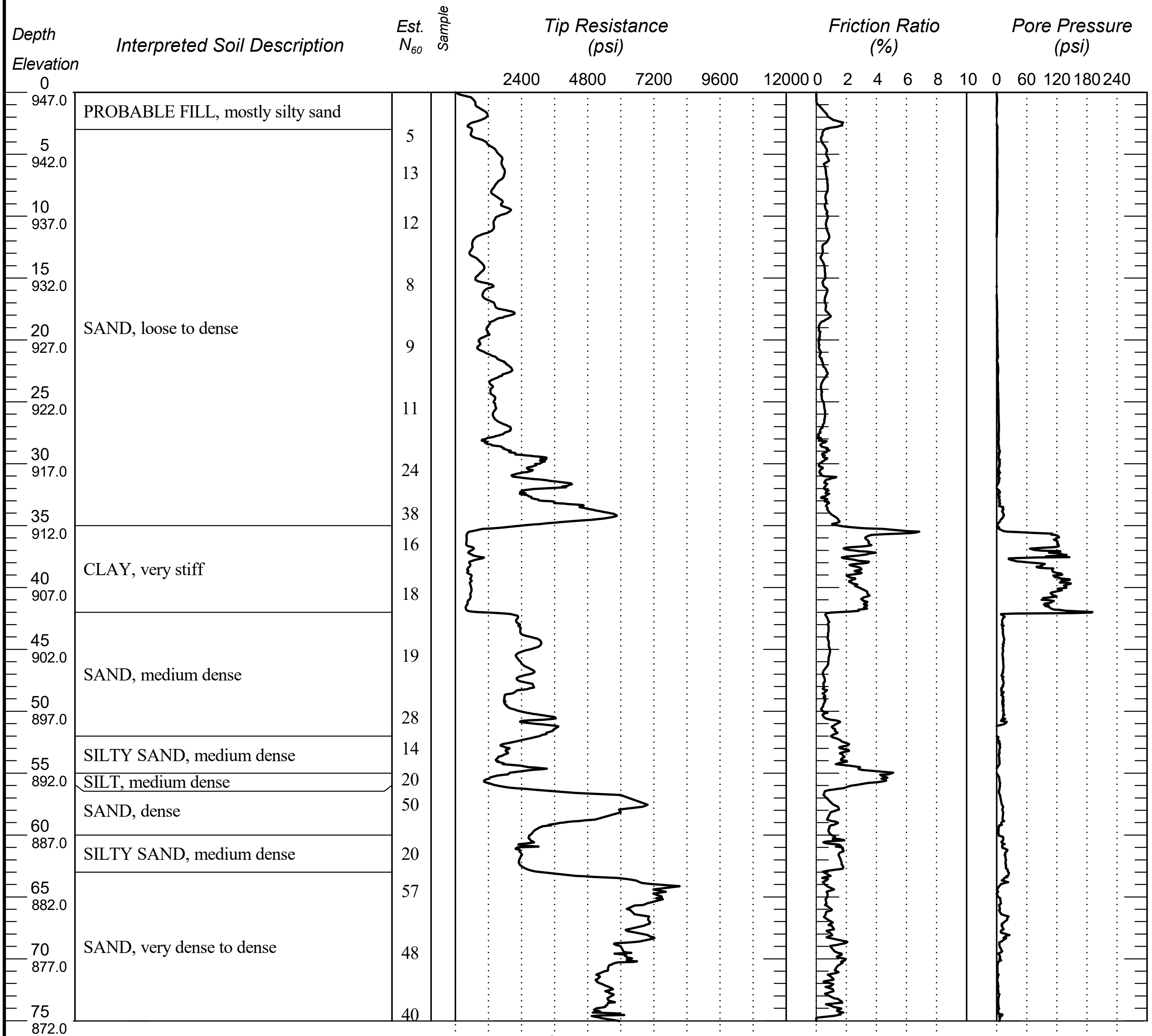
CPT Operator **Dave Adams**

Surface Elevation **947.0**

Co. Coordinates: X= Y= (feet)

Cone # **4444.184**

Date Completed: 10/18/21



Interpreted Soil Description	Est. N60
PROBABLE FILL, mostly silty sand	
SAND, loose to dense	5 13 12 8 9 11 24 38
CLAY, very stiff	16 18
SAND, medium dense	19 28
SILTY SAND, medium dense	14
SILT, medium dense	20
SAND, dense	50
SILTY SAND, medium dense	20
SAND, very dense to dense	57 48 40

Bottom of Hole 75.035

CONE PENETRATION TEST RESULTS

AET NO: **P-0005785**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Sounding No. **C-04 (p. 1 of 1)**

Location

CPT Machine **20**

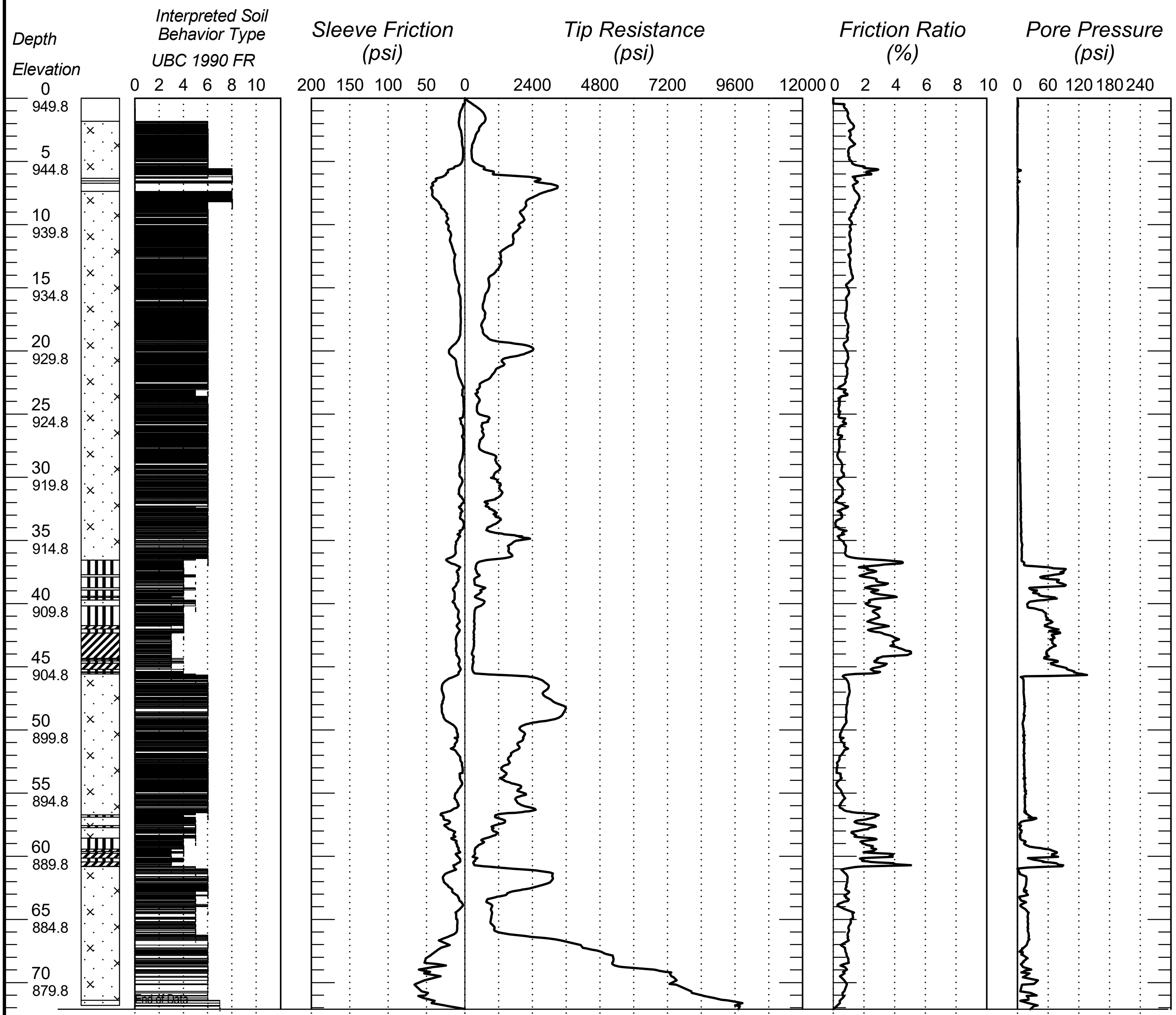
CPT Operator **Dave Adams**

Surface Elevation **949.8**

Co. Coordinates: X= Y= (feet)

Cone # **4444.184**

Date Completed: 10/18/21



Bottom of Hole 72.104

CONE PENETRATION TEST RESULTS

AET NO: **P-0005785**

Project: **Cambridge Unit 2 Dual Fuel Conversion; Cambridge, MN**

Sounding No. **C-05 (p. 1 of 1)**

Location

CPT Machine **20**

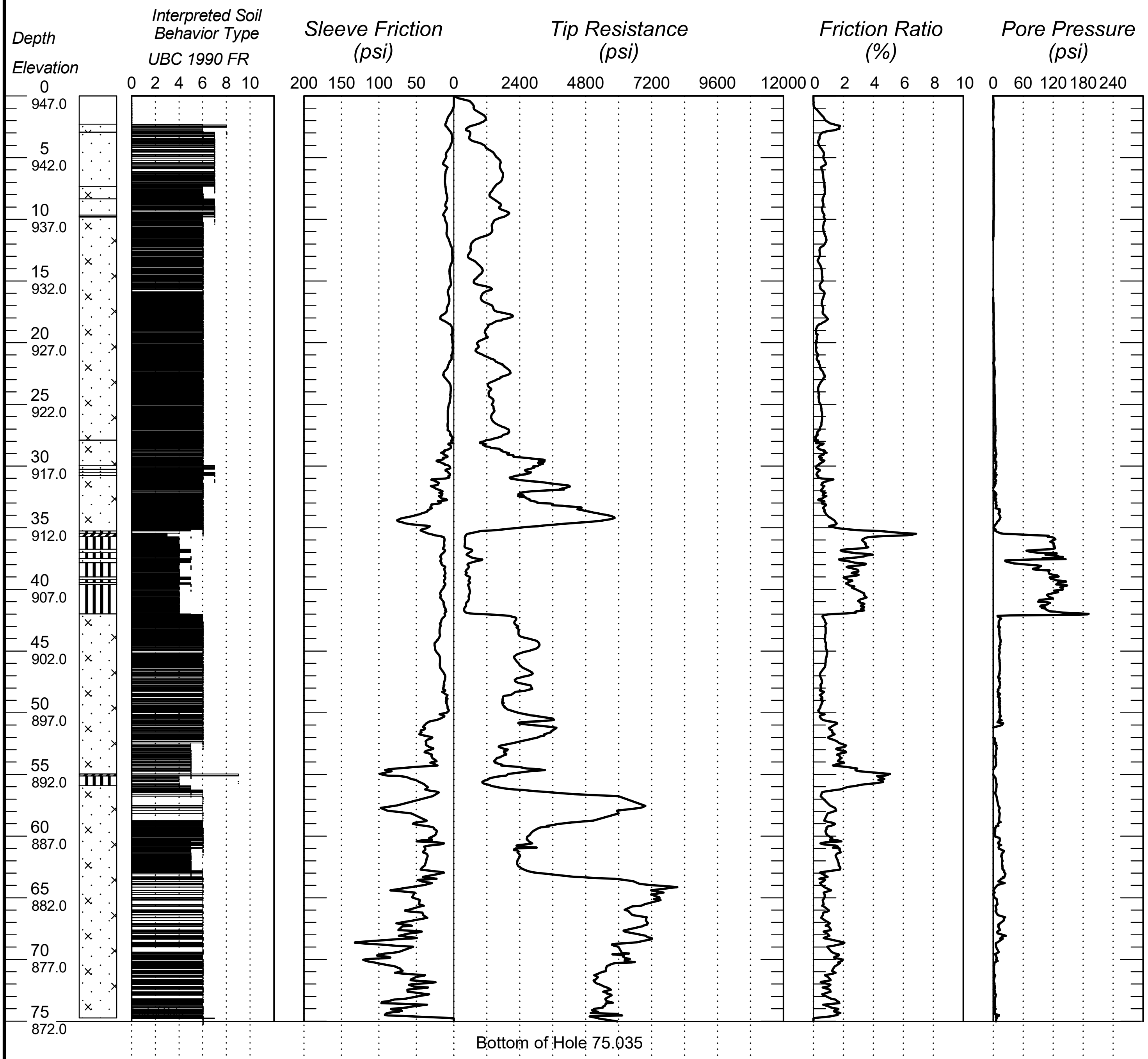
CPT Operator **Dave Adams**

Surface Elevation **947.0**

Co. Coordinates: X= Y= (feet)

Cone # **4444.184**

Date Completed: 10/18/21



Bottom of Hole 75.035

AET CPT GRAPH

Edit: Date: 11/16/21
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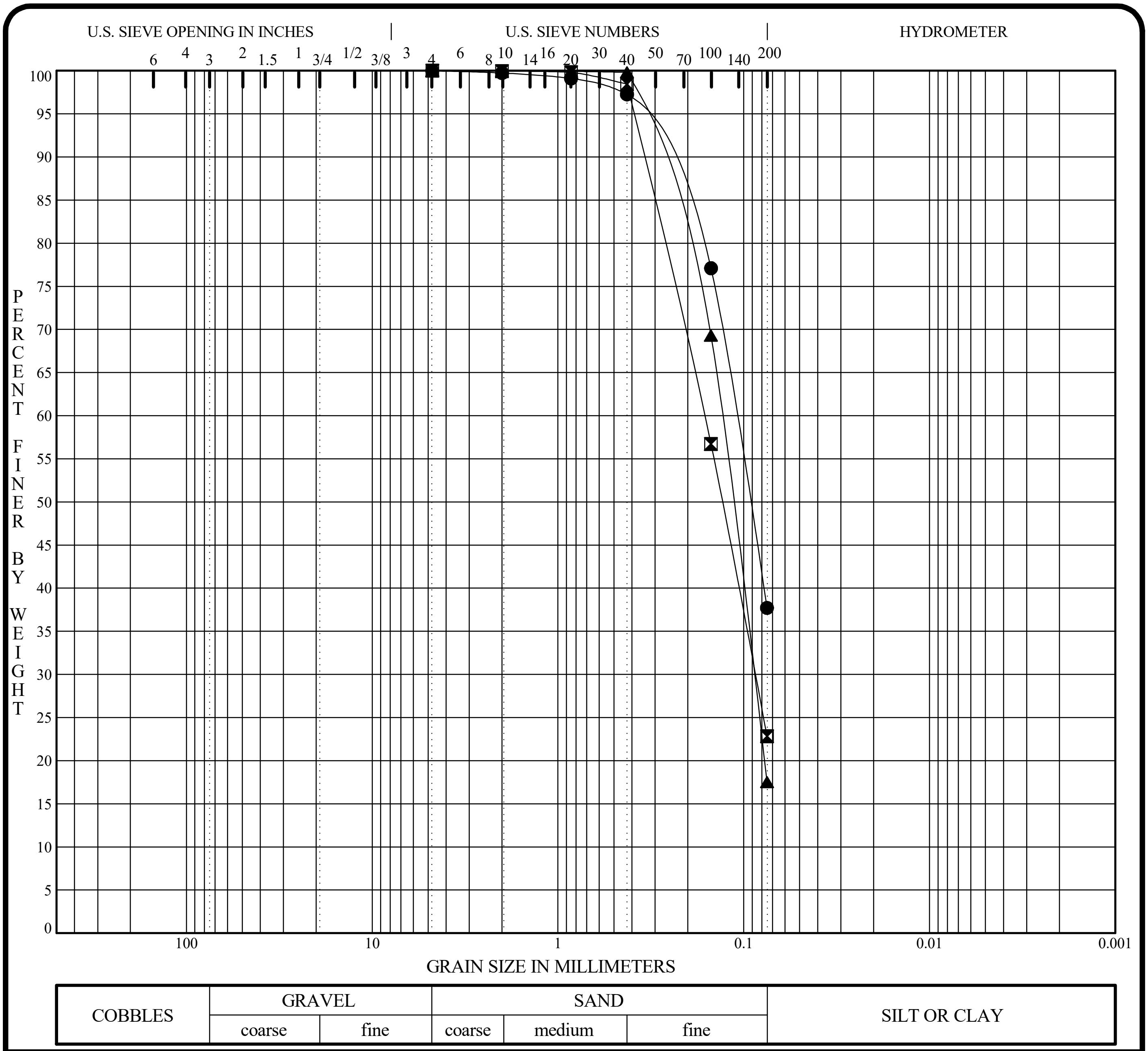
AET CPT GRAPH P-0005785.GPJ AET+CPT+WELL.GDT 11/16/21



Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● **B-18**	**3.0'**	**SILTY SAND (SM)**						
☒ **B-19**	**3.0'**	**SILTY SAND (SM)**						
▲ **B-20**	**5.5'**	**SILTY SAND (SM)**						

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **B-18**	**3.0'**	**4.75**	**0.11**			**0.0**	**62.3**	**37.7**	
☒ **B-19**	**3.0'**	**4.75**	**0.16**	**0.087**		**0.0**	**77.2**	**22.8**	
▲ **B-20**	**5.5'**	**4.75**	**0.13**	**0.089**		**0.0**	**82.5**	**17.5**	

PROJECT **Cambridge Unit 2 Dual Fuel Conversion;**
Cambridge, MN

AET JOB NO. **P-0005785**
DATE **10/7/21**

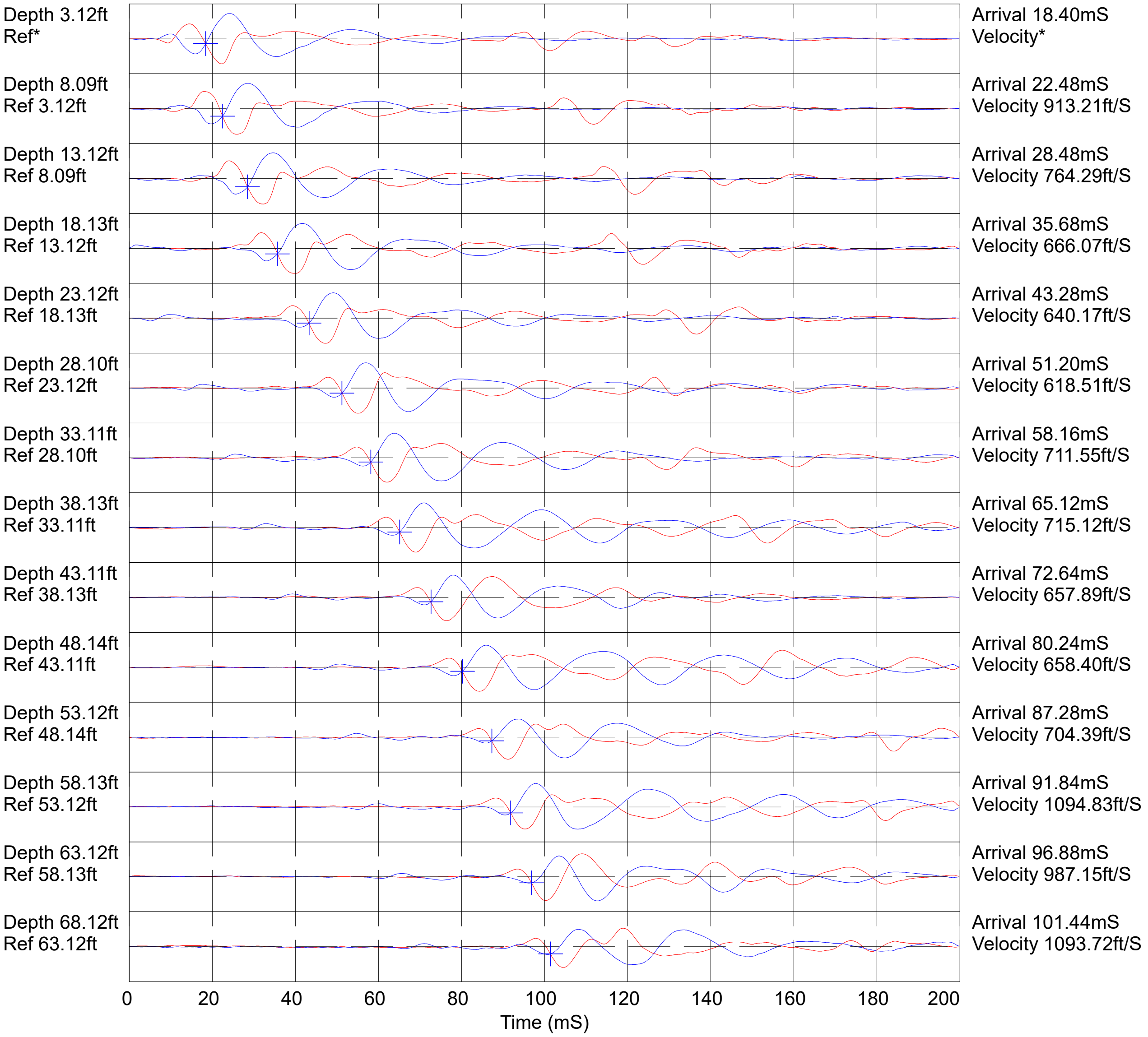
AMERICAN ENGINEERING TESTING

American Engineering Testing
550 Cleveland Avenue North
St. Paul, MN 55114
Telephone: (651) 659-9001
Fax: (651) 659-1347

GRADATION CURVES

AMERICAN
ENGINEERING TESTING

PROJECT: P-0005785

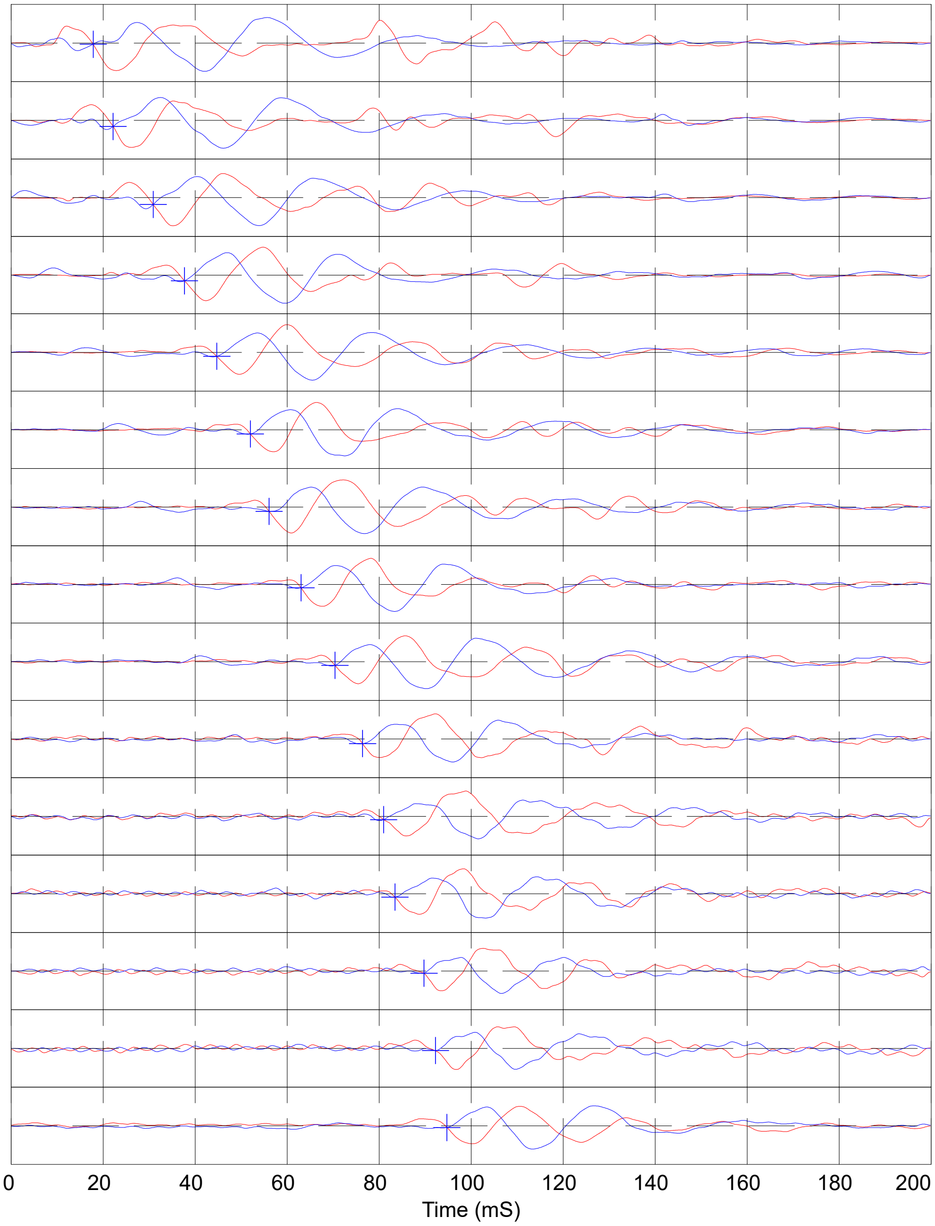


Hammer to Rod String Distance (ft): 4.67
* = Not Determined

TEST ID: C-04

PROJECT: P-0005785

Depth 3.14ft Ref*	Arrival 17.84mS Velocity*
Depth 8.13ft Ref 3.14ft	Arrival 22.16mS Velocity 867.93ft/S
Depth 13.13ft Ref 8.13ft	Arrival 30.88mS Velocity 522.99ft/S
Depth 18.10ft Ref 13.13ft	Arrival 37.68mS Velocity 699.60ft/S
Depth 23.11ft Ref 18.10ft	Arrival 44.72mS Velocity 693.83ft/S
Depth 28.11ft Ref 23.11ft	Arrival 52.00mS Velocity 675.59ft/S
Depth 33.14ft Ref 28.11ft	Arrival 56.08mS Velocity 1218.68ft/S
Depth 38.12ft Ref 33.14ft	Arrival 63.04mS Velocity 709.43ft/S
Depth 43.12ft Ref 38.12ft	Arrival 70.40mS Velocity 674.89ft/S
Depth 48.13ft Ref 43.12ft	Arrival 76.40mS Velocity 830.65ft/S
Depth 53.08ft Ref 48.13ft	Arrival 80.96mS Velocity 1080.93ft/S
Depth 58.13ft Ref 53.08ft	Arrival 83.44mS Velocity 2029.14ft/S
Depth 63.12ft Ref 58.13ft	Arrival 89.76mS Velocity 787.22ft/S
Depth 68.12ft Ref 63.12ft	Arrival 92.24mS Velocity 2011.05ft/S
Depth 73.12ft Ref 68.12ft	Arrival 94.72mS Velocity 2011.73ft/S



Hammer to Rod String Distance (ft): 4.67
* = Not Determined

TEST ID: C-05

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0005785

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by GBA[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Understand the Geotechnical Engineering Services Provided for this Report

Geotechnical engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical engineering services is typically a geotechnical engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

B.2.2 Geotechnical Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client.

Likewise, geotechnical engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. If you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

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[1] Geoprofessional Business Association, 1300 Piccard Drive, LL14, Rockville, MD 20850
Telephone: 301/565-2733: www.geoprofessional.org, 2019

B.2.3 Read the Full Report

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. Read and refer to the report in full.

B.2.4 You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, always inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

B.2.5 Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

B.2.6 This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

B.2.7 This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

B.2.8 Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical engineering report, along with any attachments or appendices, with your contract documents, but be certain to note conspicuously that you've included the material for information purposes only. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, only from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and be sure to allow enough time to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

B.2.9 Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.10 Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical engineering study. For that reason, a geotechnical engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated subsurface environmental problems have led to project failures. If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

B.2.11 Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. Geotechnical engineers are not building-envelope or mold specialists.

Appendix F Siemens Energy Noise Level Letter

Monday, May 23, 2022

Vincent Herda
Great River Energy
12300 Elk Creek Blvd.
Maple Grove, MN. 55368

Subject: Noise Level while operating fuel oil

Reference:

(1) Email from Vincent Herda to Tony Deal and Bill Doherty titled “GRE CU2 DFC – sound levels”, dated May 16th, 2022
(2) Proposal # 08062021 REV2 titled “GRE Cambridge – Fall 2023 Dual Fuel Conversion”, dated February 2, 2022.
(3) Program Parts, Miscellaneous Hardware, Program Management Services And Scheduled Outage Services Contract dated September 4, 2008 (the “LTP Contract”) between Great River Energy ("GRE") and Siemens Energy, Inc (“SEI”)

Dear Mr. Herda,

This statement concerns acoustical performance (sound level changes) involved in the permit update for the SGT6-4000F(2) gas turbine at Great River Energy, Cambridge Unit 2.

SEI does not expect an increase to the spatially averaged near field sound levels, nor to the maximum far field sound levels, after the implementation of dual fuel capability on GRE Cambridge Unit 2. SEI does not rule out some localized sound level increases around the water and fuel oil injection skids. The foregoing is only a reasonable judgment (or estimates) based on experience, not to be construed as a guarantee of any sort.

Please free to contact me if you have any questions.

Sincerely,

Kevin Uhlmansiek

Siemens Energy, Inc.
Kevin Uhlmansiek
Project Manager

CC: Tyler Felix, Kyle Leier <GRE>
Micha Mitchell, Bill Doherty, Tony Deal, Scott Harrell<SEI>

Appendix G Greenhouse Gas Calculation Table

Great River Energy - Cambridge
GHG Calculation Demonstration

Constants			Source
	2.20462	lb/kg	
	25	GWP for CH4	Table A-1
	298	GWP for N2O	Table A-1

1. Ultra Low Sulfur Diesel

Capacity	2091	MMBtu/hr	Case 10 - Baseload- 20.2 F Ambient Temperature

	kg/MMbtu	lb/MMBtu	lb/hr	Source
CO_2	73.96	163.05	340,945	Table C-1: Distillate Fuel Oil #2
CH_4	3.00E-03	6.61E-03	13.8	Table C-2: Petroleum Products (All fuel types in Table C-1)
N_2O	6.00E-04	1.32E-03	2.77	Table C-2: Petroleum Products (All fuel types in Table C-1)
CO_2e			342,115	

2. Natural Gas

Capacity	2009	MMBtu/hr	Case 1 - Baseload -20.2F Ambient Temperature

	kg/mmbtu	lb/MMBtu	lb/hr	
CO_2	53.06	116.98	235,007	Table C-1: Natural Gas
CH_4	1.00E-03	2.20E-03	4.43	Table C-2: Natural Gas
N_2O	1.00E-04	2.20E-04	0.44	Table C-2: Natural Gas
CO_2e			235,250	

Appendix H Third Party RASS Assessment

February 23, 2023

Ms. Jenna Ness
Environmental Review Manager
Energy Environmental Review and Analysis
Minnesota Department of Commerce
85 7th Place East, Suite 280
St. Paul, MN 55101

Re: Dispersion Modeling and Air Emission Risk Analysis Review
Great River Energy - Cambridge

Dear Ms. Ness,

The Minnesota Department of Commerce contracted with HDR Engineering, Inc. (HDR) to provide a technical review of the Air Emission Risk Analysis (AERA) and associated computerized dispersion modeling submitted by Great River Energy (GRE) in support of their proposed project at the GRE Cambridge generating station.

The project, as authorized by the Minnesota Pollution Control Agency (MPCA) Air Individual Permit Part 70 Reissuance No. 05900014-104, consisted of the modification of existing combustion turbine (EQUI 10) to accommodate dual-fuel capability. Specifically, EQUI 10 would have the capability to combust ultra-low sulfur fuel oil (ULSD) as a back-up fuel to natural gas. EQUI 10 would also be required to operate water injection controls while combusting ULSD.

HDR's review of the AERA documentation and associated dispersion modeling submitted by GRE confirms that the analysis conforms to MPCA AERA modeling guidelines and that the resulting risk analysis calculations accurately reflect the project as permitted.

The following paragraphs provide additional detail regarding HDR's technical review.

Proposed Project Emissions and Operating Scenarios

The GRE Cambridge facility is an existing simple-cycle combustion turbine generating station located in Cambridge, Isanti County, Minnesota. The facility consists of one 29.3 megawatt (MW) combustion turbine (EQUI 11), one 190 MW combustion turbine (EQUI 10), one black-start generator (EQUI 2), one emergency diesel fire pump (EQUI 21), and two emergency generators (EQUI 22 and 23).

EQUI 10 was originally permitted to combust only pipeline quality natural gas. The proposed project evaluated in the AERA consisted of modifying EQUI 11 to allow the combustion of ULSD as a backup fuel.

Air Emission Permit No. 05900014-104 contains a combined annual emission limit for nitrogen oxides (NO_x) for EQUI 10 and EQUI 11 of 225 tons per year (tpy) on a 12-month rolling sum basis. The annual NO_x limit effectively limits the hours of operation of EQUI 10 and EQUI 11, and thereby secondarily limits the emissions of other combustion related pollutants. There are no individual operating restrictions on the combustion turbines other than short-term maximum lb/hr emission limits and the combined annual NO_x limit. Therefore, either combustion turbine could be operated individually up to the annual NO_x limit, or some combination of the two combustion turbines and allowed fuel types could be operated up to the annual NO_x limit.

To evaluate potential operating risks from the proposed project, the AERA analysis evaluated EQUI 10 operating individually for 1,282 hours while combusting ULSD continuously. This operating scenario would result in 225 tpy of NO_x emissions and would allow no operation of EQUI 11. This is anticipated to provide a worst-case analysis as ULSD is proposed as a back-up fuel and would not typically be combusted for the entire allowable operating period. Furthermore, for every pollutant included in the AERA, except formaldehyde and carbon monoxide (CO), ULSD results in higher emission levels as compared to natural gas.

The AERA process evaluates acute, sub-chronic and chronic impacts for certain air toxics. Acute and sub-chronic impacts are evaluated using the short-term lb/hr maximum emission rates. Chronic impacts are evaluated by annualizing the ton per year emission rates based on the allowable operating hours under the primary NO_x emission cap.

A review of the emission calculations provided in Air Emission Permit No. 05900014-104 indicates that short-term maximum lb/hr emission rates were based on manufacturer provided information or the Environmental Protection Agency (EPA) AP-42 Compilation of Air Pollutant Emission Factors. HDR reviewed the emission factors for each pollutant included in the AERA to confirm the accuracy and source. Based on this review, the GRE AERA for Cambridge represents the worst-case operating scenario for the proposed project as allowed in the air emission operating permit, with the following exception.

The air emission operating permit allows for an optional operating scenario which would increase the annual NO_x emission limit from 225 to 240 tons per year if the facility installs a continuous emission monitor system (CEMS) for NO_x. This condition allows for future flexibility of increased operations in the event that GRE installs a CEMS in lieu of using manual emission tracking calculations. The resulting increase in annual NO_x emissions would allow an increase in operating hours while combusting ULSD from 1,282 to 1,367 hours. The increase in operating hours would allow a corresponding linear tpy increase of each combustion related pollutant by approximately 7%. The increase in annual emissions has the potential to impact/increase chronic risks from the proposed project. However, given that the AERA indicates chronic risks are significantly below the acceptable levels, an increase of 7% is not anticipated to result in an adverse impact.

To verify this assumption, HDR updated the AERA calculation spreadsheet to incorporate the higher annual level of pollutants under the 240 tpy NO_x operating scenario. The table below provides a comparison of chronic impacts as compared to the guidance level of 1.

Emission Scenario	**Total Inhalation Risks**		**Total Indirect Pathway Risks**		
	Chonic Noncancer	**Cancer Index**	**Farmer Cancer Index**	**Urban Gardener Cancer Index**	**Resident Cancer Index**
225 tpy Scenario	0.002	0.006	0.171	0.004	0.001
240 tpy Scenario	0.002	0.006	0.182	0.005	0.001

As indicated in the table above, the 240 tpy NOx operating scenario would not significantly increase the risk profile of the proposed project.

Finally, it was indicated previously that the formaldehyde emission factor for natural gas is higher than the formaldehyde emission factor for ULSD. It is not within the scope of the AERA to evaluate existing natural gas-fired operations, but instead only to evaluate the impact from the proposed project to combust ULSD. However, to provide a complete review in the event of mixed fuel operations, such as part-time distillate fuel and part-time natural gas, the higher emission values for formaldehyde were entered into the AERA calculation spreadsheet along with the ULSD emission factors to provide a hybrid analysis. Incorporation of the higher formaldehyde emissions resulted in no change to the AERA risk profile. Therefore, it is concluded that there would be no additional impact as a result of mixed fuel operations.

Dispersion Modeling Methodology

HDR reviewed the AERA dispersion modeling methodology for consistency with the MPCA's Air Dispersion Modeling Practices[1] (MPCA, 2022). The provided data files for the AERMOD analysis conformed to the following standard practices:

1. Model selection was appropriate for the latest version of AERMOD available at the time of the analysis.
2. Meteorological data was sourced in pre-processed format directly from MPCA. The selected surface observation site (St. Cloud, MN) and upper-air observation site (Chanhassen, MN) are appropriate for use for the Cambridge facility.
3. The modeling demonstration for EQUI10 was run for only the months of December, January, and February and is an appropriate representation of the worst-case atmospheric conditions and most-likely period for combustion of ULSD.
4. Receptor grid design and density are in alignment with MPCA guidelines.
5. Building downwash information was included in the dispersion modeling files, as calculated by the Building Profile Input Program (BPIP). The input data for BPIP was not provided for verification.
6. Exhaust characteristics for the emission units evaluated in this exercise conform to the permitted parameters for stack height, temperature, and flow rate.

The resultant concentrations were included in the AERA workbook for the relevant averaging periods for the analysis. This modeling demonstration appropriately estimates ambient concentrations for conversion to risk factors within the AERA.

Conclusions

Based on HDR's review of the AERA documentation and dispersion modeling analysis provided by GRE for the Cambridge station, the project review confirms with MPCA AREA modeling guidance and the final

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[1] https://www.pca.state.mn.us/sites/default/files/aq2-58.pdf

provided results accurately represent the project as permitted in Air Emissions Permit No. 05900014-104.

If you have any questions regarding HDR's technical review or require additional information, please do not hesitate to contact me at (763) 278-5905, or graetz@hdrinc.com.

Sincerely,
HDR Engineering, Inc.

Gregory J. Raetz, PE
Senior Professional Associate

Appendix I DNR NHIS Letter

DEPARTMENT OF
NATURAL RESOURCES

Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

February 10, 2023
Correspondence # MCE 2022-00841

Tyler Conley
Barr Engineering Company

RE: Natural Heritage Review of the proposed Cambridge Station Unit 2 Combustion Turbine,
T36N R23W Section 21; Isanti County

Dear Tyler Conley,

As requested, the Minnesota Natural Heritage Information System has been reviewed to determine if the proposed project has the potential to impact any rare species or other significant natural features. Based on the project details provided with the request, the following rare features may be impacted by the proposed project:

State-listed Species

- Blanding's turtles (*Emydoidea blandingii)*, a state-listed threatened species, have been reported in the vicinity of the proposed project and may be encountered on site. For additional information, please see the Blanding's turtle fact sheet, which describes the habitat use and life history of this species. The fact sheet also provides two lists of recommendations for avoiding and minimizing impacts to this rare turtle. **Please refer to the first list of recommendations for your project.** If greater protection for turtles is desired, the second list of additional recommendations can also be implemented. The use of erosion control blanket shall be limited to 'bio-netting' or 'naturalnetting' types, and specifically not products containing plastic mesh netting or other plastic components. Also be aware that hydro-mulch products may contain small synthetic (plastic) fibers to aid in its matrix strength. These loose fibers could potentially re-suspend and make their way into Public Waters. As such, please review mulch products and not allow any materials with synthetic (plastic) fiber additives in areas that drain to Public Waters.

  The Blanding's turtle flyer should be given to all contractors working in the area. If Blanding's turtles are found on the site, please remember that state law and rules prohibit the destruction of threatened or endangered species, except under certain prescribed conditions. If turtles are in imminent danger they must be moved by hand out of harm's way, otherwise they are to be left undisturbed.

- Please visit the DNR Rare Species Guide for more information on the habitat use of these species and recommended measures to avoid or minimize impacts. For further assistance with these species, please contact the appropriate DNR Regional Nongame Specialist or Regional Ecologist.

Federally Protected Species

- To ensure compliance with federal law, conduct a federal regulatory review using the U.S. Fish and Wildlife Service's (USFWS) online Information for Planning and Consultation (IPaC) tool.

Environmental Review and Permitting

- Please include a copy of this letter and the MCE-generated Final Project Report in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location and project description provided with the request. If project details change or the project has not occurred within one year, please resubmit the project for review within one year of initiating project activities.

The Natural Heritage Review does not constitute project approval by the Department of Natural Resources. Instead, it identifies issues regarding known occurrences of rare features and potential impacts to these rare features. Visit the Natural Heritage Review website for additional information regarding this process, survey guidance, and other related information. For information on the environmental review process or other natural resource concerns, you may contact your DNR Regional Environmental Assessment Ecologist.

Thank you for consulting us on this matter and for your interest in preserving Minnesota's rare natural resources.

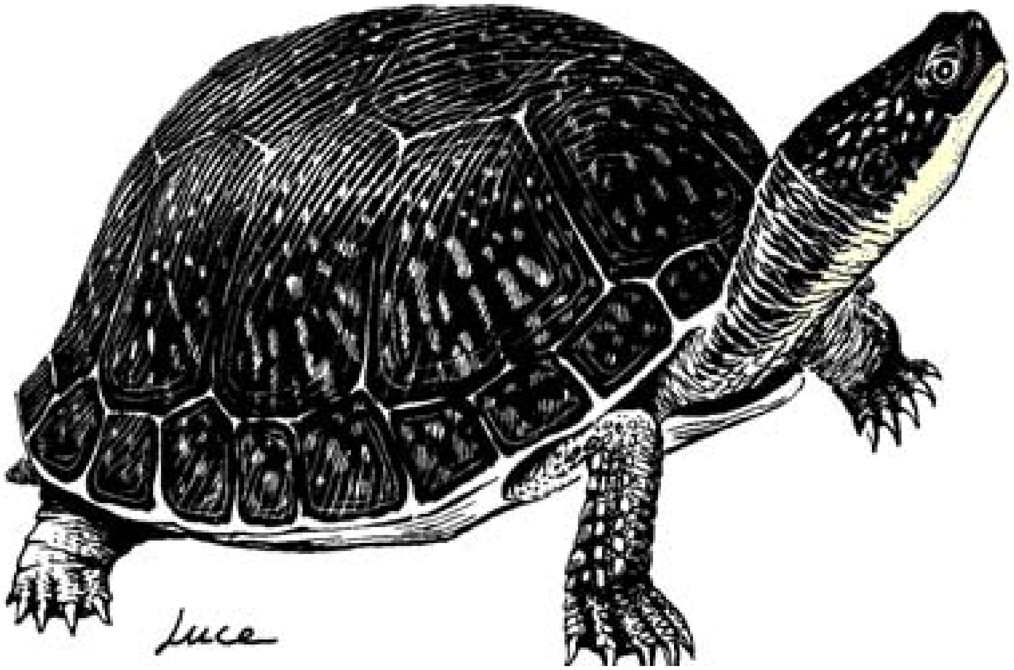
Sincerely,

James Drake

James Drake
Natural Heritage Review Specialist
James.F.Drake@state.mn.us

Cc: Melissa Collins

CAUTION



BLANDING’S TURTLES

MAY BE ENCOUNTERED IN THIS AREA

The unique and rare Blanding’s turtle has been found in this area. Blanding’s turtles are a State Threatened species and are protected under Minnesota Statute 84.095, Protection of Threatened and Endangered Species. Please be careful of turtles on roads and in construction sites. For additional information on turtles, or to report a Blanding’s turtle sighting, contact the DNR Nongame Specialist nearest you: Bemidji (218-308-2641); Grand Rapids (218-327-4518); New Ulm (507-359-6033); Rochester (507-280-5070); or St. Paul (651-259-5764).

DESCRIPTION: The Blanding’s turtle is a medium to large turtle (5 to 10 inches) with a black or dark blue, dome-shaped shell with muted yellow spots and bars. The bottom of the shell is hinged across the front third, enabling the turtle to pull the front edge of the lower shell firmly against the top shell to provide additional protection when threatened. The head, legs, and tail are dark brown or blue-gray with small dots of light brown or yellow. A distinctive field mark is the bright yellow chin and neck.

Illustration by Don Luce, from Turtles in Minnesota, Natural History Leaflet No. 9, June 1989, James Ford Bell Museum of Natural History

SUMMARY OF RECOMMENDATIONS FOR AVOIDING AND MINIMIZING IMPACTS TO BLANDING'S TURTLE POPULATIONS

(see Environmental Review Fact Sheet Series for full recommendations)

- A flyer with an illustration of an adult Blanding's turtle should be given to all contractors working in the area. Homeowners should also be informed of the presence of Blanding's turtles in the area.
- Turtles which are in imminent danger should be moved, by hand, out of harms way. Turtles which are not in imminent danger should be left undisturbed to continue their travel among wetlands and/or nest sites.
- If a Blanding's turtle nests in your yard, do not disturb the nest, and do not allow pets near the nest.
- Blanding's turtles do not make good pets. It is illegal to keep this threatened species in captivity.
- Silt fencing should be set up to keep turtles out of construction areas. It is critical that silt fencing be removed after the area has been revegetated.
- Small, vegetated temporary wetlands should not be dredged, deepened, or filled.
- All wetlands should be protected from pollution; use of fertilizers and pesticides should be avoided, and run-off from lawns and streets should be controlled. Erosion should be prevented to keep sediment from reaching wetlands and lakes.
- Roads should be kept to minimum standards on widths and lanes.
- Roads should be ditched, not curbed or below grade. If curbs must be used, 4" high curbs at a 3:1 slope are preferred.
- Culverts under roads crossing wetland areas, between wetland areas, or between wetland and nesting areas should be at least 36 in. diameter and flat-bottomed or elliptical.
- Culverts under roads crossing streams should be oversized (at least twice as wide as the normal width of open water) and flat-bottomed or elliptical.
- Utility access and maintenance roads should be kept to a minimum.
- Because trenches can trap turtles, trenches should be checked for turtles prior to being backfilled and the sites should be returned to original grade.
- Terrain should be left with as much natural contour as possible.
- Graded areas should be revegetated with native grasses and forbs.
- Vegetation management in infrequently mowed areas -- such as in ditches, along utility access roads, and under power lines -- should be done mechanically (chemicals should not be used). Work should occur fall through spring (after October 1st and before June 1st).

Compiled by the Minnesota Department of Natural Resources Division of Ecological Resources, Updated March 2008
Endangered Species Environmental Review Coordinator, 500 Lafayette Rd., Box 25, St. Paul, MN 55155 / 651-259-5109

Appendix J SHPO Letter

DEPARTMENT OF
ADMINISTRATION
STATE HISTORIC PRESERVATION OFFICE

January 13, 2023

VIA EMAIL ONLY

Adam Salzer
Great River Energy
12300 Elm Creek Blvd
Maple Grove, MN 55369

RE: Cambridge Station Unit 2 Combustion Turbine Ultra-Low Sulfur Diesel (ULSD) Alternative
T36 R23 S21, Cambridge Twp, Isanti County
SHPO Number: 2023-0645

Dear Adam Salzer:

Thank you for the opportunity to comment on the above referenced project. Information received on December 19, 2022, has been reviewed pursuant to the responsibilities given the State Historic Preservation Office by the Minnesota Historic Sites Act (M.S. 138.666).

We have reviewed the documentation provided in your submission and based on information that is available to us at this time, we have determined that there are **no properties** listed in the National or State Registers of Historic Places, and no known or suspected archaeological properties located in the area that will be affected by this project.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.

If you have any questions regarding our review of this project, please contact Kelly Gragg-Johnson, Environmental Review Program Specialist, at 651-201-3285 or kelly.graggjohnson@state.mn.us.

Sincerely,

Sarah J. Beimers

Sarah J. Beimers
Environmental Review Program Manager